THE FOUNDRY

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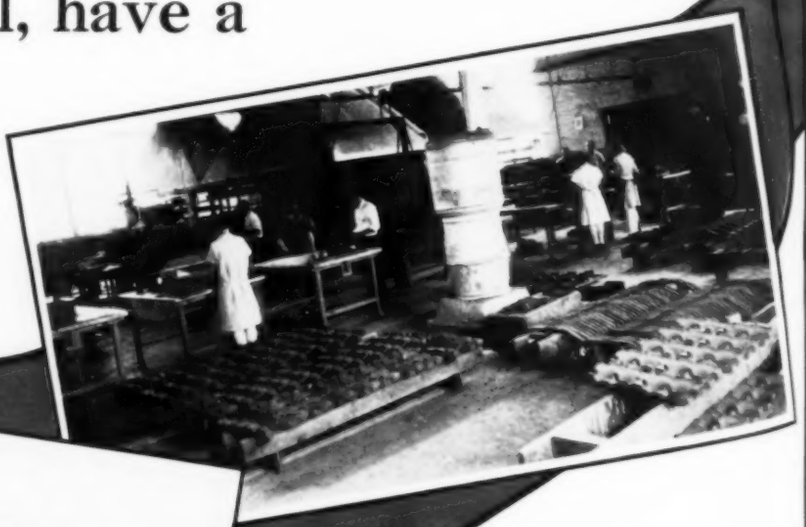
ADVERTISING PAGES REMOVED

celebrating their 25th anniversary
G. & C. Foundry in Sandusky, Ohio

25 Years of LINOIL USING

"Yes, we have used Linoil since the day our foundry opened and we are proud of the work we have done with it. G. & C. castings, like Linoil, have a reputation for quality."

—JOHN E. CARROLL, *Pres.*



A pleasant environment, neat and orderly shop, modern equipment, the best in craftsmen, materials, and supplies, is the G. & C. formula for the very comfortable business enjoyed. Linoil cores at left.

EDITORIAL

Is Further Expansion Needed In the Foundry Industry?

IN NOVEMBER 1939, shortly after the outbreak of the war in Europe, THE FOUNDRY made the following statement editorially, which seems to bear repetition at this time: "One lesson of the 1914-18 era should be studied again by the entire industry. In the boom days of war demand, many new foundries were built and many additions were constructed to existing plants. Some of these plants failed to produce a single casting and few profited sufficiently from the war business to pay for the heavy investments. For approximately ten years following the armistice, the foundry industry suffered from a tremendous excess of plant capacity which made profitable operation almost impossible. Unless plans for expansion have been under consideration for some time and are based upon normal requirements rather than the present distorted situation, it seems rather sensible to believe that now is not the time to invest in bricks and mortar. The immediate problem pertains to equipment. Every consideration should be given to replacing obsolete machines with modern equipment, and to the further installation of equipment capable of improving practices and working conditions."

At that time, this discussion represented the opinion of many leaders in the field, but in the past twenty months, ideas concerning the need for building new foundry capacity have undergone a radical change. Since the American defense effort got under way early last summer, a sizable number of new foundries have been built in all four branches of the industry and many plant additions have been completed. Today, the expansion fever seems to grow more vigorous as foundries already filled to capacity with orders, a large percentage of which is war work, covet the additional business which could be secured if only greater production facilities were available. It would appear to the observer that the entire foundry industry is indulging in an orgy of expansion, which may or may not be necessary to meet the demands of a war economy, but which undoubtedly will provide the hangover headache at some time in the future. Up to the present, the industry as a whole has not studied carefully the possible future demands of the armed forces for castings to be used in war materiel, or the ability of the entire foundry industry to meet these demands.

Perhaps the greatest expansion to date has taken place among steel foundries, gray iron shops producing machine tool castings, and light metal foundries engaged in the manufacture of castings for aircraft and other war materials. In the case of steel foundries, where many primary contracts have been awarded for cast steel armor plate for tanks, cast steel bombs such as are illustrated elsewhere in this issue, ordnance castings, truck parts, marine castings and many other products, the cost of expansion of capacity during the past year probably exceeds $10,000,000, and the end is not as yet apparent. Undoubtedly it is true that if the war pattern follows present indications, an additional heavy burden will be placed upon the foundry industry.

As a matter of protection for the nation and the foundry industry, both for the immediate future and for that period when peace again returns to the world, accurate statistics on the present situation are most essential. Data should be collected to determine the following information: 1—Probable future war demand; 2—Percentage of foundry capacity now engaged in defense work carrying a preference rating or which can be identified as bearing directly on the production of materials essential to war; 3—Idle foundry capacity which can be directed to the needs of the present emergency; 4—Number of shifts each plant is working and the feasibility of working three shifts; 5—Adequacy of labor supply to handle full three-shift operation; 6—Availability of raw materials, possible reasons for shortages in the various districts, and the steps Washington must take to provide the satisfactory flow of these materials into the wide variety of castings needed for modern war.

With such information, the ability of the four branches of the industry to meet the demands of the war effort can be determined, and the nation's defense need not suffer through lack of adequate facilities for the production of castings. At the same time, such information, when used properly as a yardstick to measure production facilities, will tend to prevent needless over expansion, and the use of materials in building plants which might now be available for the actual production of needed castings.

Frank G. Steinebach
Editor

Why Gray Iron Piston R

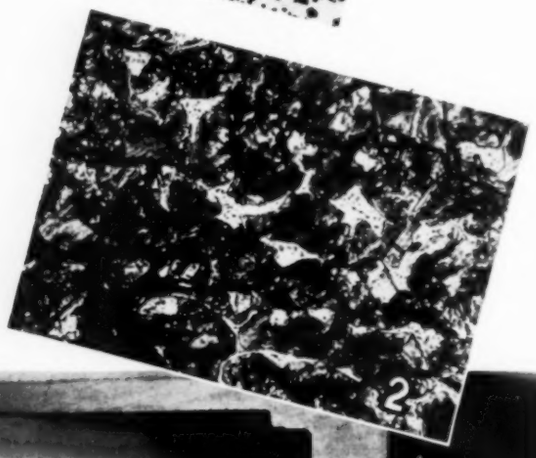
FOR AIRCRAFT

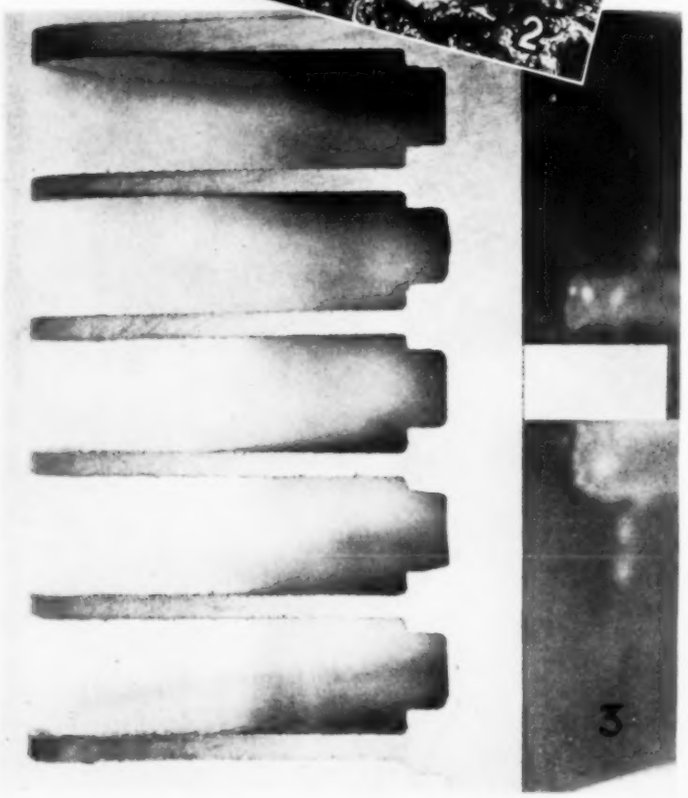
THE 100 horsepower engine in your automobile weighs approximately 5 pounds per horsepower developed. The 1000-2000 horsepower engines in our modern airliners and military aircraft weigh only slightly over 1 pound per horsepower developed.

In your automotive engine many parts are made of gray cast iron—in the high output aircraft engine the piston rings are the only part still made from this material.

Obviously, this has come about as a result of reduction in engine weight for a given horsepower developed. To hold this factor to a minimum, aluminum and magnesium alloys have been substituted wherever practicable. In parts which are highly stressed, such as crankshafts, connecting rods, cylinders, etc., alloy steel is used to give maximum strength for minimum weight.

Why, then, do we find cast iron still in general use for the piston rings when stronger steel





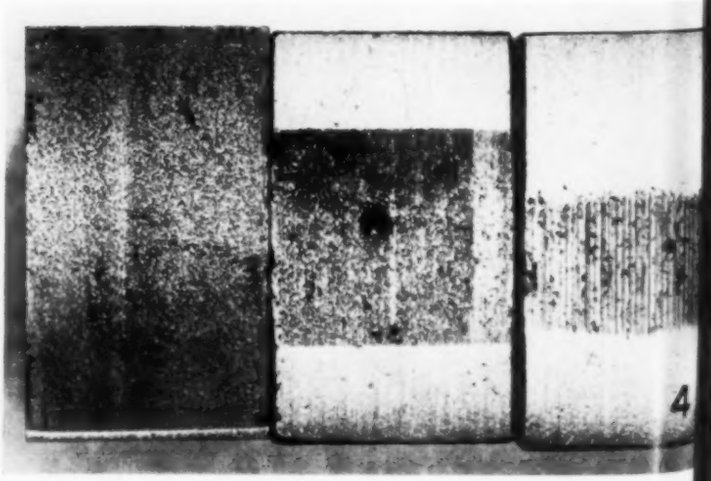


Fig. 1—Graphite form and distribution in ring. Dense, uniform precipitation with excellent scuff resisting qualities. 100 diameters, unetched. Fig. 2—Sorbitic matrix of eutectic composition characterized by mesh structure of phosphide constituent. Good heat resistance and wear properties. 500 diameters, nital etch. Fig. 3—Section of air-cooled cylinder and ring enlarged 4 2/3 times. Actual ring section is 3/32 x 5/32-inch. Fig. 4—Surface conditions of worn areas illustrate difference in scuff resistance and weight loss of different structures. Fig. 5—Network pattern of steadite compounds confers bearing properties and retards wear. Fig. 6—Structural sectional view of steel engine cylinder, right, and gray iron piston ring, left. Compatible combination from scuffing viewpoint. Iron ring holds cylinder abuse to minimum

Rings

T E N G I N E S ?

base materials would seem available? Several important qualities peculiar to cast iron alone account for this practice.

First, the physical properties of piston ring iron are very different from those indicated by the chemical specification for such material. Navy department specification No. 49R3a for piston rings for aircraft call for the following chemical limits:

Silicon, per cent	2.10 to 3.10
Sulphur, per cent	under 0.10
Phosphorus, per cent	0.30 to 0.80
Manganese, per cent	0.40 to 0.80
Graphitic carbon, per cent	2.70 to 3.20
Combined carbon, per cent	0.45 to 0.75
Rockwell hardness—"B" Scale	97-104
Brinell hardness—Equivalent	225-275

A composition like that given would not at first glance indicate an iron of high physical properties nor does the specified silicon content appear to check with the relatively high hardness obtained. However, this composition when poured into individual ring castings of less than ⅛-inch in thickness and weighing only 2 ounces each results in a material of excellent density, strength, and structural uniformity, since cooling is extremely rapid.

Largely as a result of the foundry practice used, rings made of the above composition test 45,000 to 50,000 pounds per square inch when the ring itself is used as a tensile bar or specimen. (This same composition as poured in 0.875-inch ASTM—AFA standard test bars will show around 25,000 pounds per square inch.) Such material has excellent heat resistance to the temperatures encountered — 600 degrees Fahr. maximum. Furthermore, the elastic or "spring qualities", as would be expected from its modulus values — 15,000,000 pounds per square inch, make it admirably adaptable for *spring* purposes.

Iron of such physical properties must in turn have a microstructure of first quality. A typical unetched section at 100 diameters is shown in Fig. 1. It is characterized by an abundant precipitation of fine graphite as a normal result of the accelerated cooling. This form of graphite confers certain desirable wear properties as will be pointed out later.

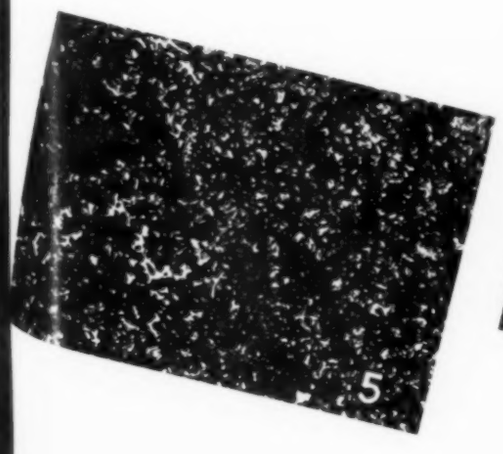
Fig. 2 shows the etched structure at 500 diameters. It is seen that this structure is basically eutectoidal with a matrix of sorbitic pearlite reinforced by a network or mesh structure of the phosphorus constituent steadite. The view of Fig. 5 at 10 diameters etched better illustrates this latter feature.

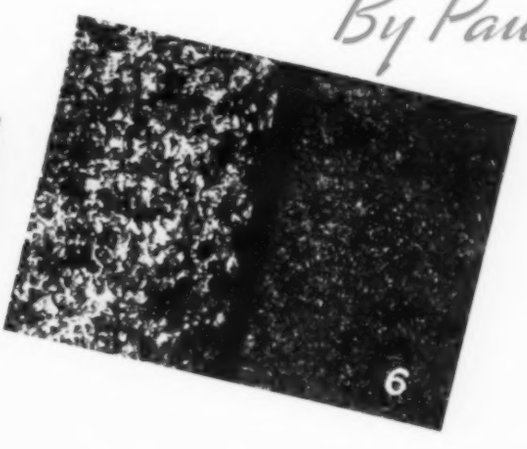
Prevent Free Carbide Formation

It will be appreciated that such structures border on the hypereutectic phase, that is, they cool just slow enough to prevent free carbide formations. Prevention of free carbides results from close control of all factors pertaining to raw materials, cupola practice, molding, gating, and risering, pouring, etc. The average gray iron foundryman usually is surprised to learn of the coke ratios, melting speed, and other foundry procedures peculiar to this specialized field.

Wear characteristics of gray cast iron account more than anything else for its continued application for rings. Present-day aircraft engines usually receive their *major overhaul* — which covers complete tear-down and replacement of worn parts—after every 400 to 600 hours' operation (50,000 to 100,000 miles). Aircraft rings as now produced normally give fairly satisfactory performance over this period of service, after which the usual and recommended practice is to replace them with new ones. They are a relatively inexpensive part in spite of their major importance in successful engine performance.

Rings must maintain their efficiency over the previously mentioned period without undue





By Paul Lane

Research Engineer
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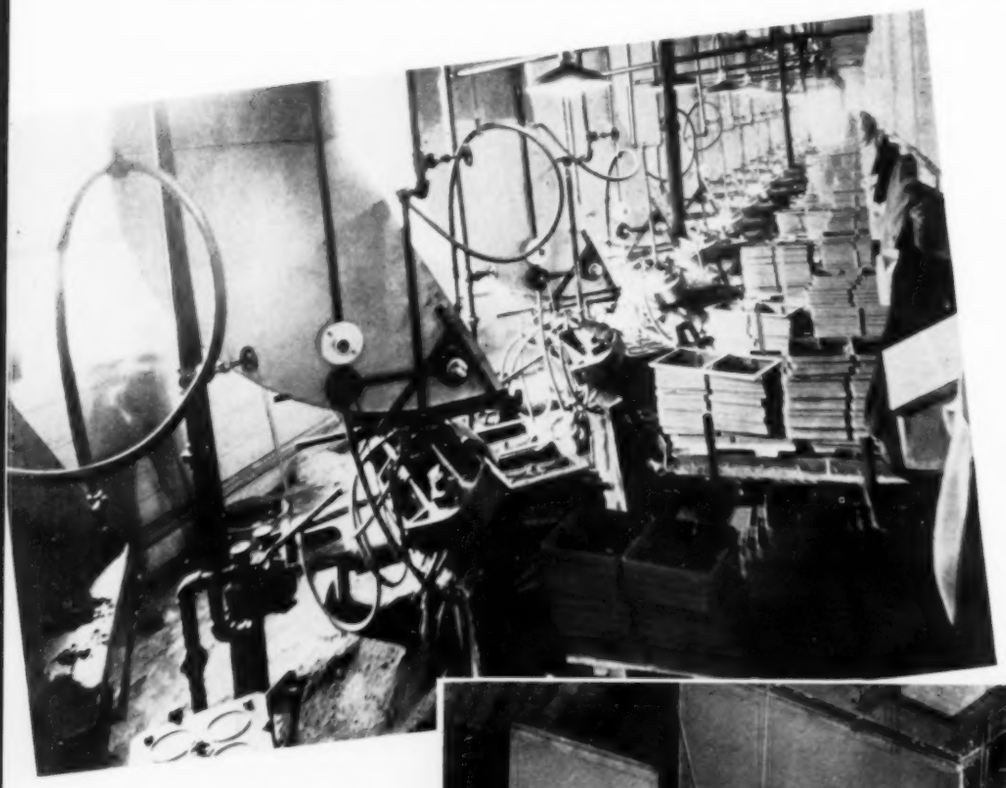
Muskegon Piston Ring Co.
Muskegon, Mich.

abuse to the cylinders against which they operate. In engines of less than 150 horsepower, cast iron cylinders are used with good success, and here the wear problem closely follows that of automotive engines. In the larger engines for airline and military usage, steel cylinders are universally used.

These are usually forgings (weighing 75 pounds originally, and only 15 pounds after final machining) made from plain carbon steel (250 brinell hardness) — chrome-molybdenum steel (320 brinell hardness)—or in the case of very hard cylinders—carburized or nitrided steel (1000 brinell hardness). These latter are rapidly becoming standard for the larger engines.

Since the *barrels* are relatively expensive (as much as $75 each), it is desired that the wear or abuse on them be held to an absolute minimum. A piston ring material which obtains reduced wear at the expense of the cylinder would have no appeal to the engine manufacturer. Thus it is necessary to confer on the ring structure suitable wear properties to obtain the desired result. Fig. 4 shows the worn surface of three wear test specimens all of gray cast iron. These have been run dry on a brake shoe type wear testing machine as described by the author in *Transactions* of the A.F.A., 1937, under identical conditions. The amount of wear or weight loss is indicated by the width of the worn area. The specimen *A*, to the right, is of a structure which shows high weight loss but possesses the ability to wear clean.



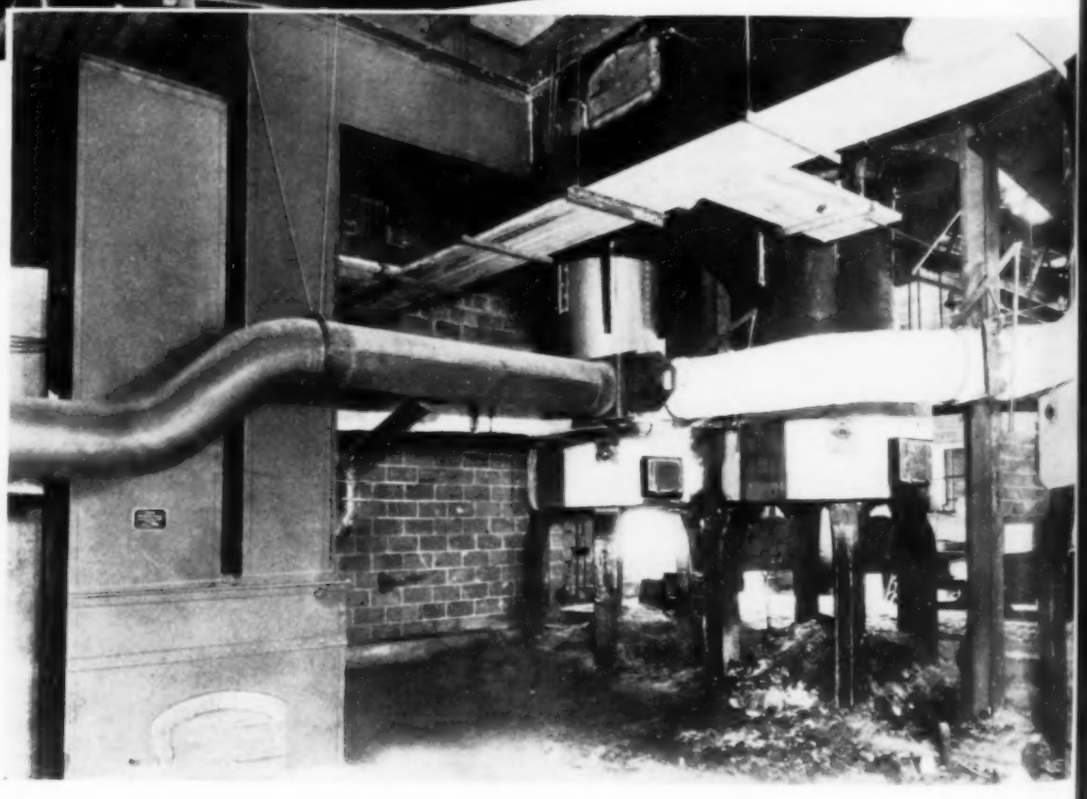


Fig. 7 (Above)—Battery of molding machine for producing molds for automotive and aircroft piston rings. Molds are conveyed through wall to a separate pouring station. Fig. 8 (Right)—Rear view of piston ring cupolas with air preheater. From dehumidifying unit the air passes through blast volume control unit, and thence through preheater shown at left which preheats air to 400 degrees Fahr.

The iron in the center specimen, *B*, is an average composition which often wears satisfactorily but lacks the clean wearing actions of the iron to the left. Its weight loss is average. The third specimen, *C*, to the right is a coarse grained iron with low weight loss but with pronounced scuffing tendencies. To quote from a previous paper by the author in the *S.A.E. Journal*, October, 1939:

Piston-ring irons, though *poor-wearing* on a weight-loss basis, do have the significant and desirable faculty of wearing away with very little tendency to accumulate wear products on their rubbing surface. This statement merely means that they are not normally prone to scuffing action. Instead, their very make-up dictates a ready sloughing or powdering action under frictional forces, due to their structural composition previously described. In fact, the ability of ready release of wear products without surface blemishing or mutilation is probably of equal or more importance than actual low weight loss.

It will be obvious rings must have such structures that their wear action approaches that of specimen *A* in Fig. 4. The other structures, while giving lower weight-loss or "dimension change" would result in increased cylinder abuse.

This is illustrated further by the figures shown in the accompanying table, giving wear results of iron and steel ring specimens when run against SAE-4140 steel of 315 brinell (representing the cylinder) for 1 hours under dry operation.

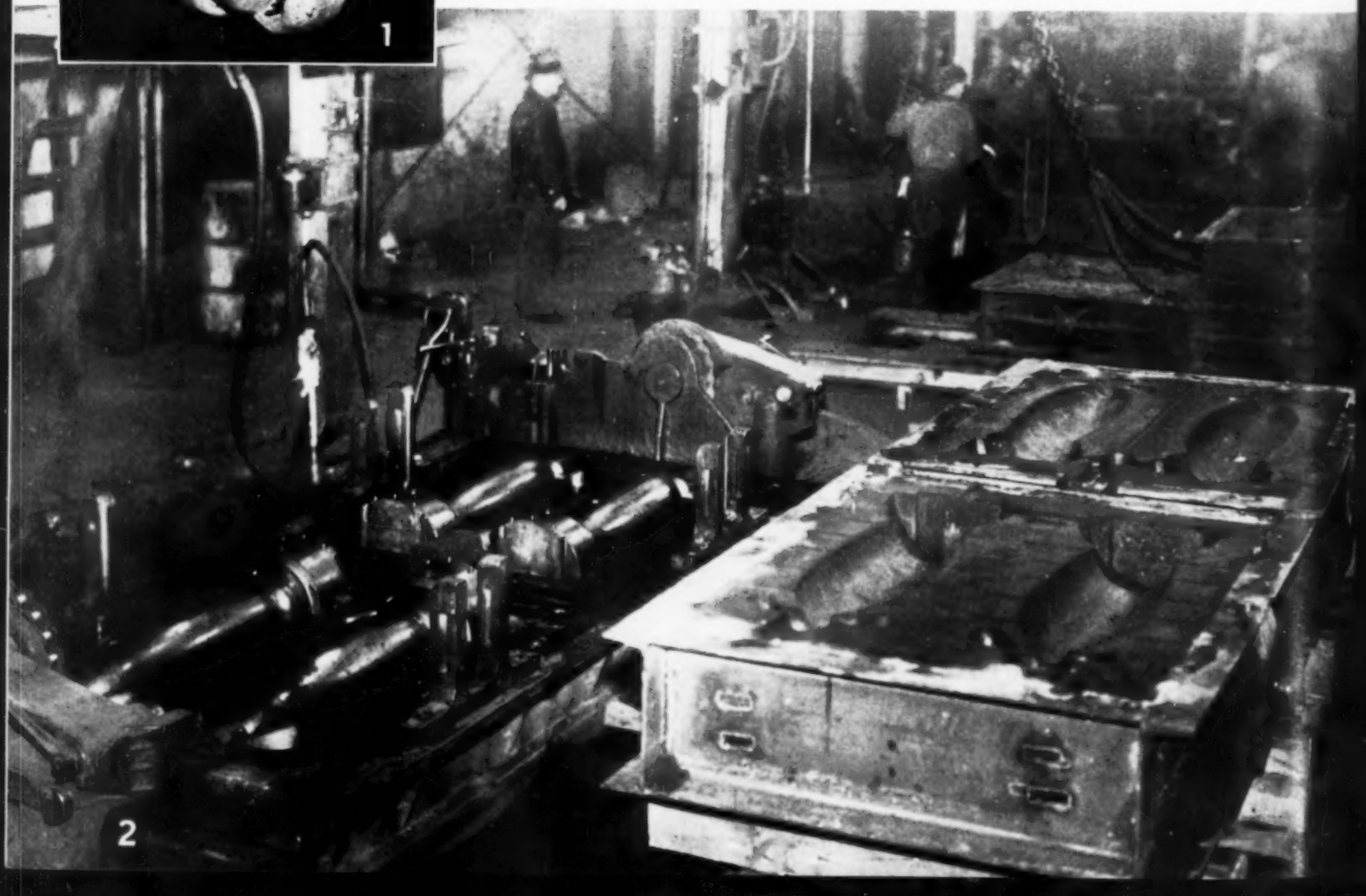
The values are of (*Please turn to page* 112)

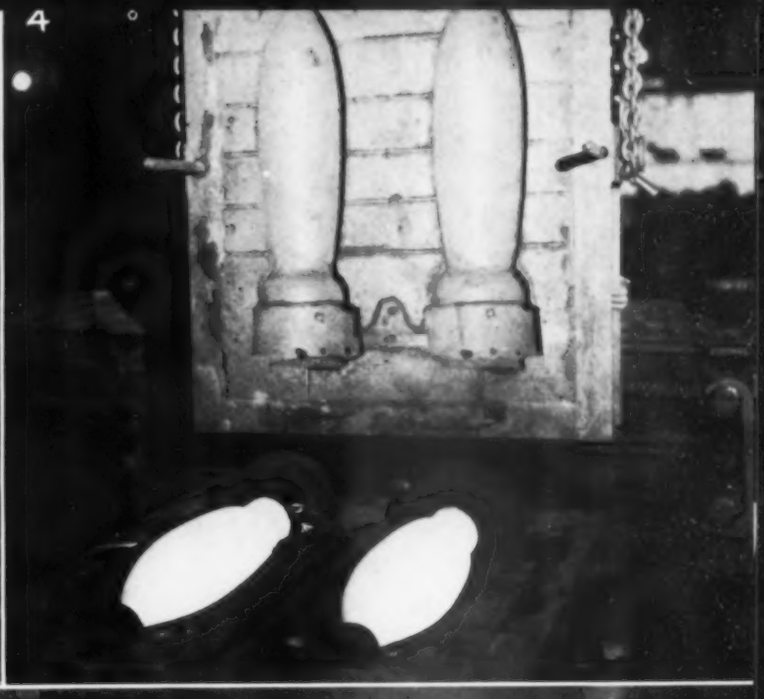
Fig. 8 (Above)—Foundry control laboratory with complete facilities for maintaining accurate checks and control of all raw materials. Fig. 9 (Left) — From the cupolas iron is conveyed to molds run out from each molding machine on conveyors. After pouring molds are conveyed to a separate shakeout department. Empty flasks are returned to molding machines on a return conveyor, and process is repeated

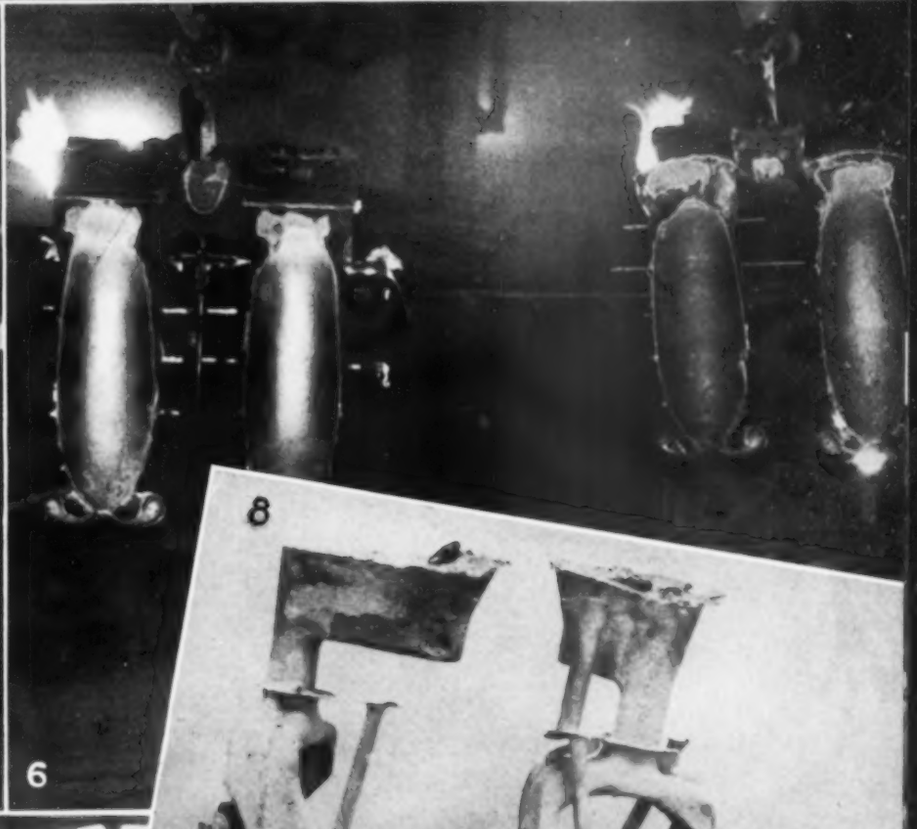
SYMINGTON-GOULD MAKES *Cast Steel Bombs*

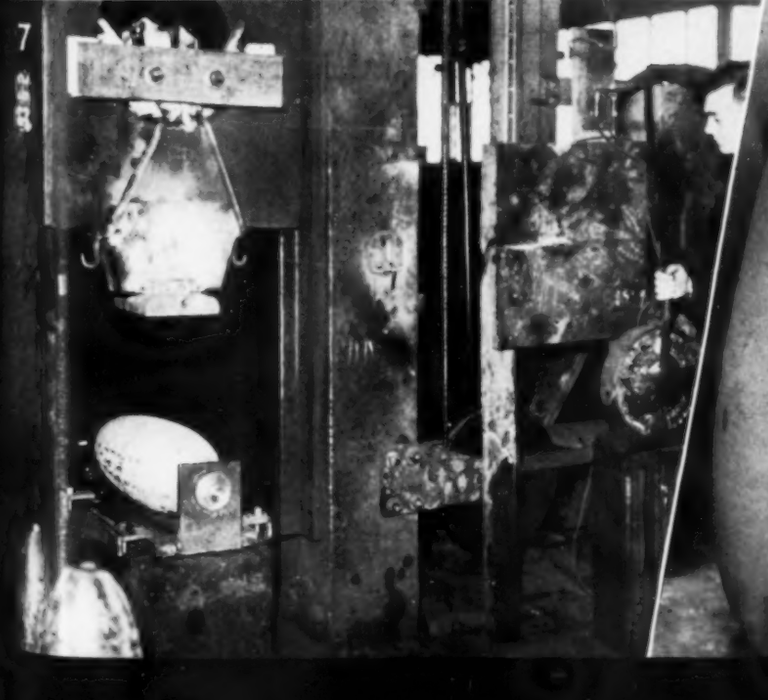
This pictorial display shows various steps in the production of 250-pound cast steel bombs in the Symington-Gould Corp. foundry, Rochester, N. Y. Fig. 1—Two hundred fifty-pound bomb casting with gate and riser attached, after abrasive blasting. Fig. 2—Cope and drag molds stripped from patterns on molding machine. Fig. 3—Applying refractory coating to cores employed to form interior of 250-pound bomb casting. Fig. 4—Drag mold with cores in place, and cope mold in position preparatory to closing the mold. Fig. 5—Pouring the molds from a 25-ton ladle. Fig. 6—Cast steel bomb castings as removed from the molds. Fig. 7—Proof-testing a 250-pound bomb body under a 2000-pound drop hammer. Fig. 8—Abrasive blasted bomb castings with gates and risers attached in foreground. Completely machined bombs are shown in the background

Photos courtesy OEM





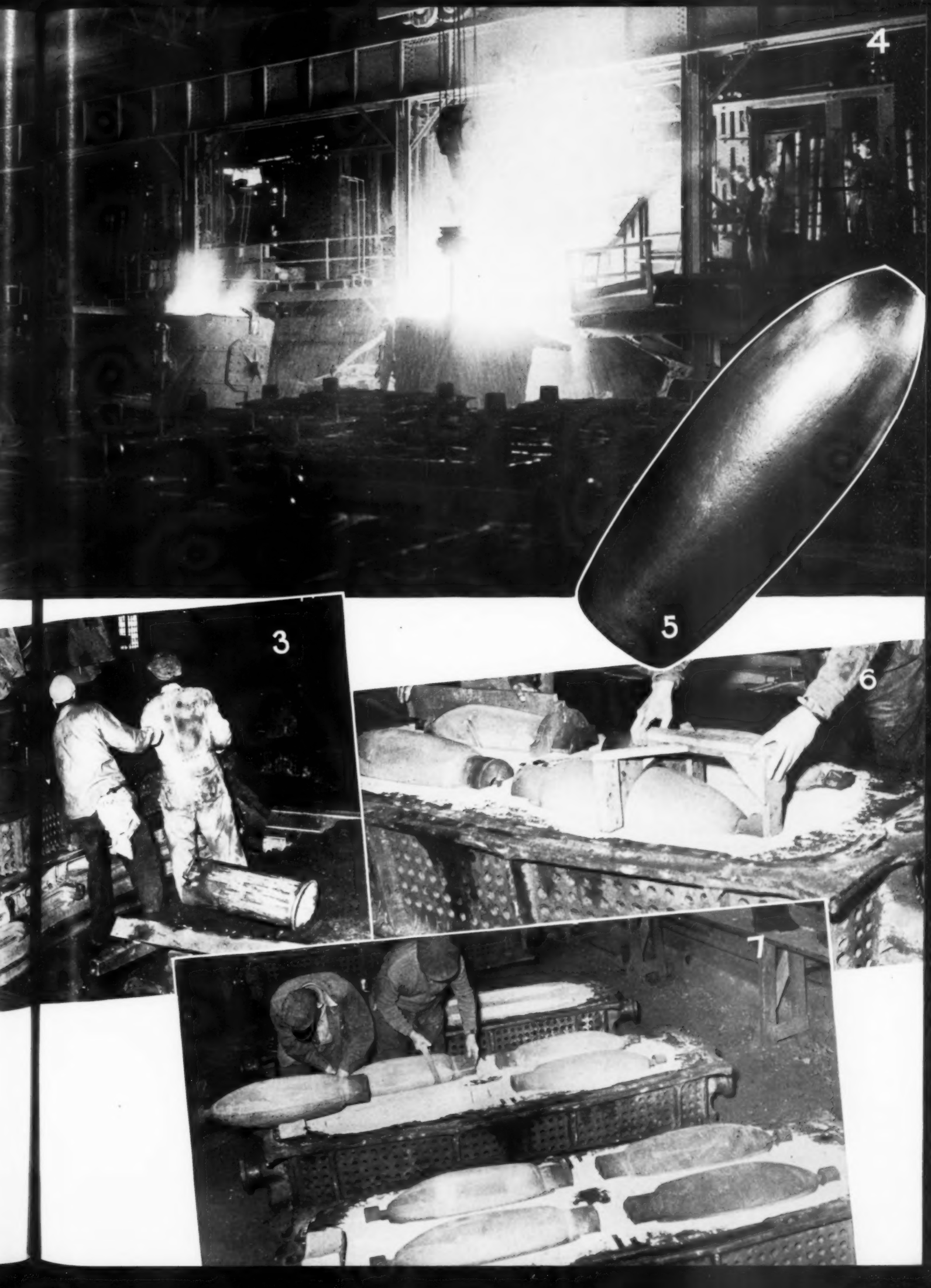




Producing Cast Steel Bombs

AT SCULLIN STEEL

Fig. 1—View of pattern department showing bomb casing patterns in foreground, matched four on a board. Daily inspection is made of the patterns at the end of each shift. Patterns are checked and repaired. Fig. 2—Bomb casings are made on Herman jolt-rollover molding machines. New sand facing is placed against the face of the patterns to insure smooth, clean surfaces. Fig. 3—Back-up or heap sand is fed into the molds by conveyor feeders and leveled off before the Herman jolter starts in operation. The number of jolts is kept constant in order to obtain accurate results. Fig. 4—Tapping a heat from one of the 30-ton furnaces. Note bomb casing molds in the foreground. Fig. 5—Close-up of completed cast steel bomb. Fig. 6—After cores are placed in the mold they are inspected. Gage on the right locates core for height while the gage on the left locates the core for length. Fig. 7—Metal thickness gages also are used in order to obtain correct metal thickness in final casting. Photos courtesy OEM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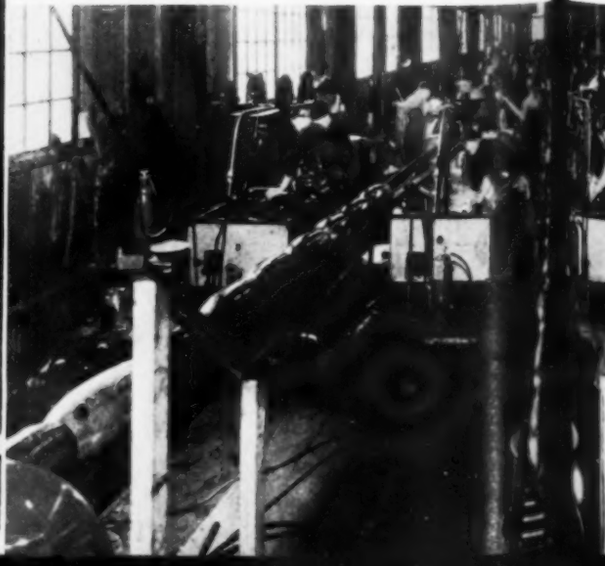
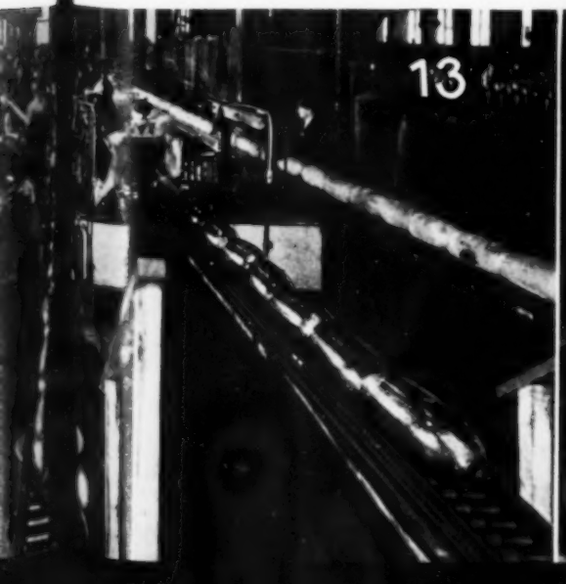


Fig. 8—After molds are complete and ready to close much care is taken to prevent shifting. Flasks are equipped with case hardened bushings in each end and are checked daily for wear. This is necessary in order to meet the close tolerances allowed. Fig. 9—Much care must be taken by the ladlemen pouring these bomb casing molds. If poured too hard they will cause strained castings which will be overweight and exceed allowable weights given on drawing. Fig. 10—After bomb casings have been removed from the mold, they are sent to the roughing floor. The first operation is the removal of gates and risers, which are burned off with cutting torches using natural gas and oxygen. Fig. 11—After the removal of gates and risers, the roughers then remove everything from the inside of the bomb casing including core rods, core sand and any fins which may appear on the casing. Fig. 12—On entering the finishing department the bomb casings are placed on conveyors and the first

operation is inspection. Then casings are passed on to the chippers to remove all excess metal from them. They then are passed to the grinder to be ground smooth. Fig. 13—General view of finishing conveyors showing testing tanks in the foreground. After casings have passed all tests and inspection they are dipped in oil. This is an extra precaution to prevent rusting while in transit to machine shop. Fig. 14—Close up of testing tanks. Bomb casings must be tested at a pressure of 50 pounds under water for one minute. This is done to check soundness of casings. Fig. 15—Close up of grinder using long portable grinder on the inside of the bomb casing. It is very important that the inside be smooth and free from all imperfections. Fig. 16—Molds are skin dried with natural gas in order to eliminate any moisture coming in contact with molten metal. Small spots shown in mold are vent holes which allow gases to escape from mold freely. Photos courtesy OEM



SOME FUNDAMENTAL

By E. J. ASH, Associate Professor
and ERIK O. LISSELL
University of Michigan, Ann Arbor, Mich.

COMPARATIVELY little has been written about the real influence of water on molding sand. It has been stated that water greatly changes the frictional resistance of grains as high moisture contents. This is not true. Water as such has no effect on frictional resistance in amounts greater than about 1.5 per cent. (Its effect when clay is present will be considered later.)

Water added to a clay-free sand will increase the frictional resistance of the grains. This means that the dry apparent density decreases and the intergranular space increases, as indicated by the curves in both Figs. 2 and 3 in the July issue. The frictional resistance increases very rapidly at first, and then slows down gradually until a point is reached where the dry apparent density remains constant (flat portion of curves). That percentage of water lies between 1 and 2 per cent water addition, approaching the higher amount with finer grained sands.

Has No Effect on Friction

As the water content is increased, it tries to surround the individual grains with a water film. The film grows thicker and stronger, and increases the friction between grains until a critical film thickness is reached. Any increase in water content above that critical amount has no influence on friction. The critical amount of water is greater for a fine grained sand because the surface area is greater.

The dry apparent density or dry weight of the same sand is therefore constant and independent of water content above 2 per cent moisture (provided there is no change in the surface condition of sand grains). The apparent density, on the other hand, increases as a hyperbolic function

$$D_g = D_d + \frac{D_g M}{100}$$

where D_g = green apparent density in grams per cubic centimeter; D_d = dry apparent density in grams per cubic centimeter, and M = moisture content in per cent. At moisture contents from 2 to 12 per cent, this function may be represented by a straight line (Fig. 2).

True density for the two sands was determined by means of a density bottle having a volume of 50 milliliters of water at 15 degrees Cent. The values obtained were: Ottawa sand, 2.65 and No. 7 angular, 2.64.

Percentage of sand grains per unit volume, and the interstitial volume or *voids* were calculated from the dry density values and the true densities given above. Fig. 3 shows the relationship between interstitial volume and moisture content. The *dry voids* are constant and independent of moisture above 2 per cent. In all the calculations, it has been assumed that the density is uniform throughout the specimens. (*Please turn to page* 130)

Fig. 6—Sketch illustrates progressive distribution of moisture when added to dry sand grains. Fig. 7—Effect of moisture on height of rammed angular sand with constant weight. Fig. 8—Effect of moisture on green and dry permeability. Ottawa unsieved sand indicated by O. Shaded area indicates moisture range where green permeability exceeded dry. Fig. 9—Effect of moisture on green and dry permeability of angular sands. No. 7 refers to unsieved sand. Fig. 10—Summary effect of moisture on permeability, intergranular volume, weight of rammed specimen and flowability using 40-mesh round grains

Table II

Index of Ramming the Sand

Sand	Angular Sand	Round Sand
100-mesh		100 — 43.0 — 42 = 15.0
70-mesh	100 — 50.2 — 42 = 7.8	100 — 42.0 — 42 = 16.0
50-mesh	100 — 49.6 — 42 = 8.4	100 — 41.4 — 42 = 16.6
Unsieved	100 — 49.3 — 42 = 8.7	100 — 41.7 — 42 = 16.3
40-mesh	100 — 49.0 — 42 = 9.0	100 — 40.8 — 42 = 17.2
30-mesh	100 — 47.5 — 42 = 9.5	
1/3 100-mesh + 2/3 40-mesh		100 — 37.5 — 42 = 20.5

Note: The A.F.A. specimen is therefore not duplicable on this basis.

ASPECTS OF

Foundry Sand

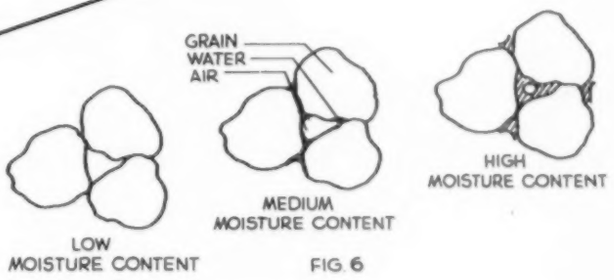


FIG. 6

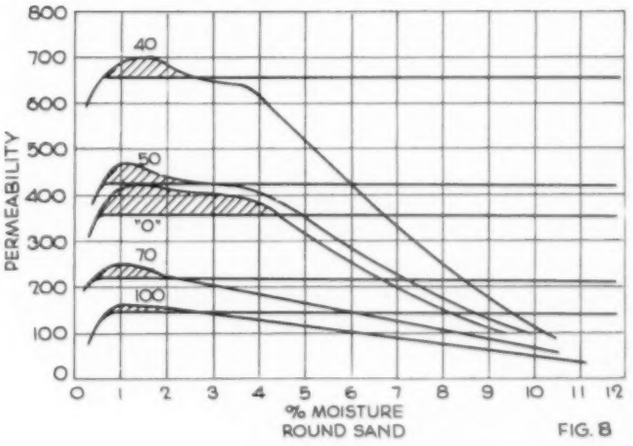


FIG. 8

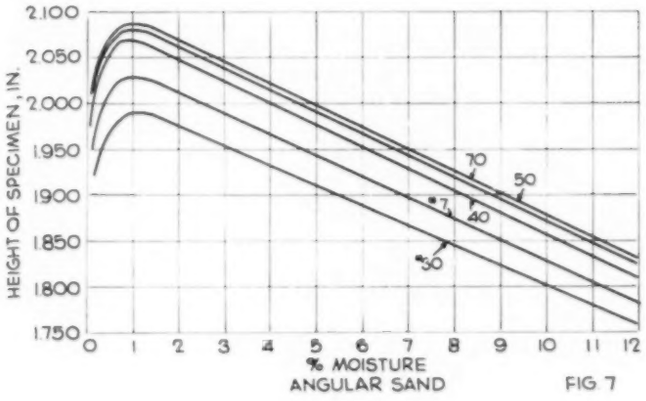


FIG. 7

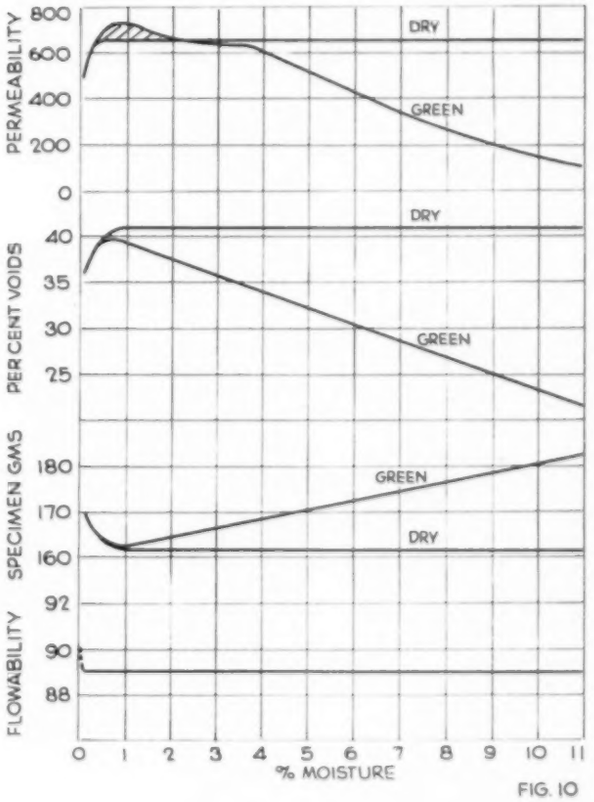


FIG. 10

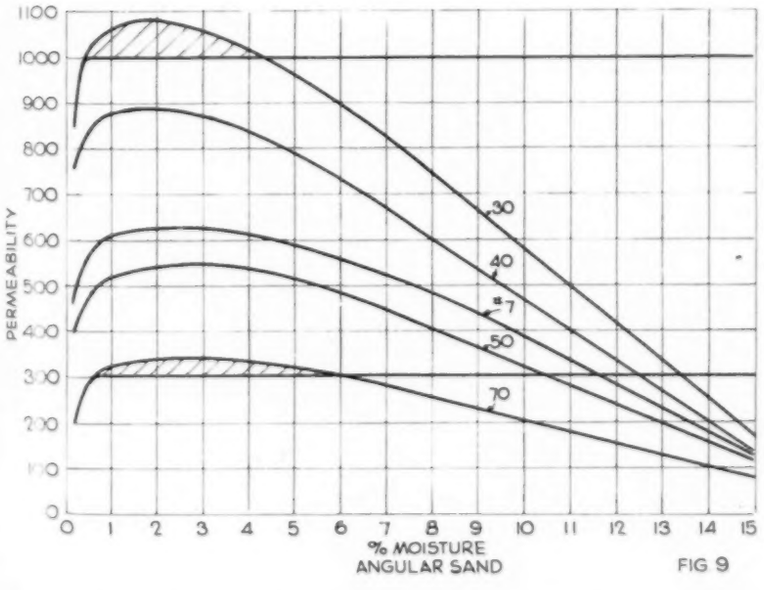


FIG 9

Speeds Machine Tool Production TO AID DEFENSE

By PAT DWYER

PART of the coremaking department in the foundry of the Gisholt Machine Co., Madison, Wis., with the sand mixing section on a mezzanine floor above the battery of ovens is shown in Fig. 11. The flat cores in the right foreground serve as copes on the molds for certain types of castings. The sand is rammed by hand in a plain corebox which then is clamped to a plate and rolled over. The entire operation is simple and requires no great degree of skill. The dried core simplifies the making of the mold in which the pattern is provided with a tapered print which extends around the edge of the cope side.

The dried core is removed from the core plate, turned over and lowered into the special print in the mold. Taper on the outside of the core corresponds to the taper on the pattern core print. A small triangular block in the corebox cuts a corner from the core and thus provides a definite guide for setting the core in the correct position in the mold where a corresponding corner has been formed by the print.

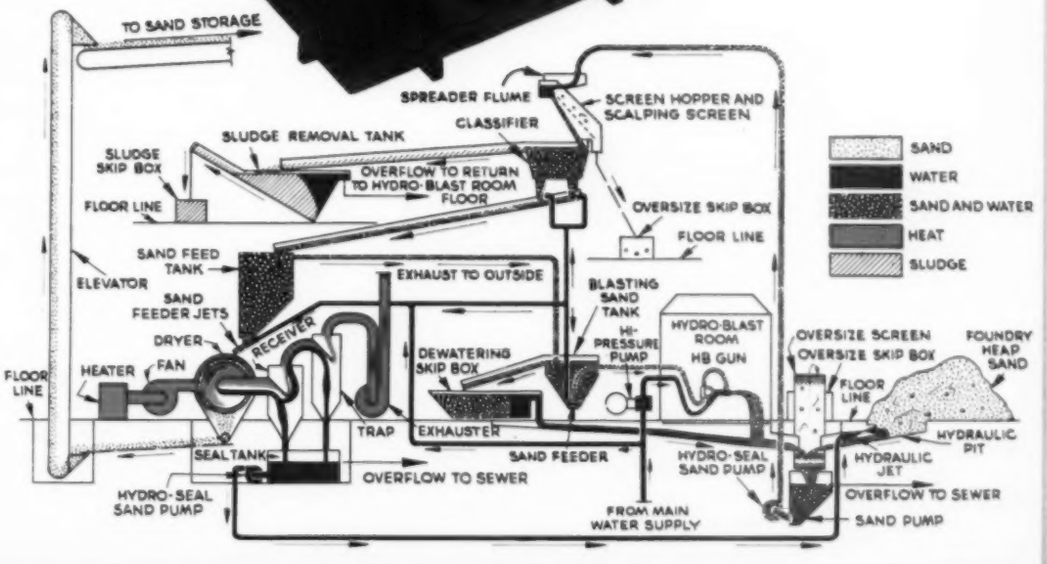
These cores are made from a mixture of new silica and bank sand bonded with a cereal binder. If the picture had been taken at another time of the day it would have showed a varied collection of large and in many instances intricate cores for the lathe beds. These cores are made entirely from sand reclaimed from the wash plant where the castings are cleaned. The sand is washed, screened, purified from fines, drained, classified according to grain size and then transferred to the sand mixing department. It retains the black color acquired in former use, but it is claimed this factor does not affect the necessary qualities in any manner. Cereal and clay binders are added in varying amounts as determined by the condition of the sand. Two lathe bed gear box cores made from this material are shown right and left near the center of Fig. 11.

Sand Stored in Concrete Bins

Small cores, principally from oil bonded sand mixtures are made in a second core room in the bay on the far side of the mezzanine floor and battery of car type core ovens. Cores are made on the bench in the ordinary manner and dried in several rack and shelf type ovens.

New sand from the ground floor level is lifted by an elevator and discharged on to a series of belts which discharge the sand into any designated one in a row of concrete bins. The belts are mounted at an angle of approximately 45 degrees and overlap each other in a

Fig. 8 (Opposite page)—Well lighted and roomy pattern shop is fully equiped with benches and power tools. Fig. 9 (Above, right) — Stud chaplets bear against the face of the cope and hold the cores in place in the turret lathe bed mold. Shallow end of the flask is supported on temporary blocking. Fig. 10 (Right) — Sectional view of hydroblast installation showing location of different units and method of operation. Fig. 11 (Below)—Core sand is mixed on a mezzanine floor and delivered to the core room floor in small wheeled trucks suspended from the crane. Most of the cores are made from washed and graded sand reclaimed by the hydroblast



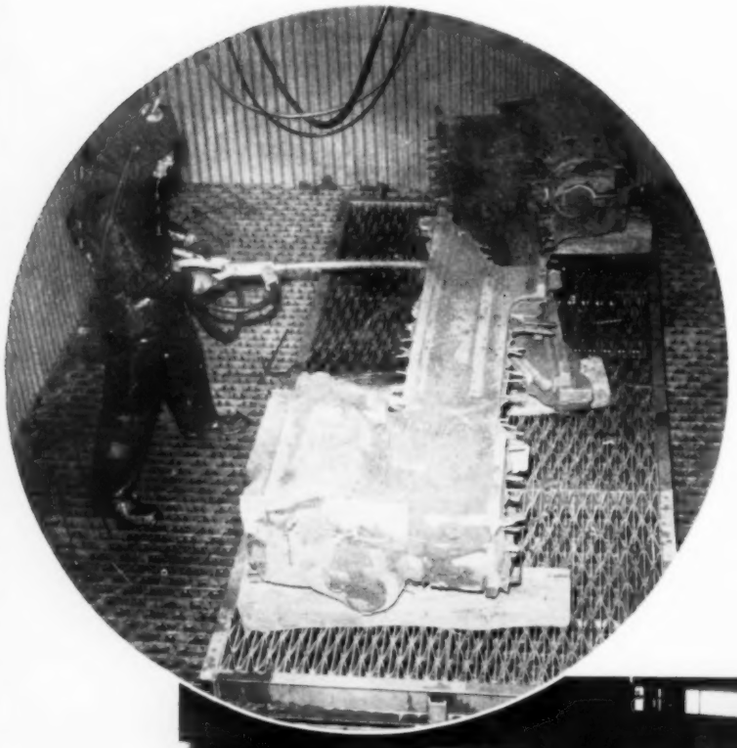
manner that permits the sand to flow from one to another if necessary instead of discharging to the bins immediately below. Sand from the washer may be dumped at the foot of the elevator, or it may be carried in small boxes suspended from the crane which spans this bay. The boxes are provided with loops at the top for attaching the chain hooks, and with wheels underneath for movement over the concrete floor.

Batches of core sand are mixed in two paddle type mixers made by the Blystone Mfg. Co., Cambridge Springs, O., and in three muller type circular containers with revolving rollers made by the National Engineering Co., Chicago. Exceptions are necessary occasionally, but as a general rule the oil sand mixtures are prepared in the paddle type mixers, while the mixtures containing the dry binders are prepared in the muller type mixers. Through constant repetition on a standard product the various mixtures readily are maintained and the department requires only a minimum amount of labor, attention and supervision.

Sand Is Prepared Carefully

Facing sand for the molders is prepared in a device made by the Royer Foundry & Machine Co., Kingston, Pa., which it is claimed removes trash, wedges, sprues, tramp iron and core butts; breaks lumps and clay balls; mixes and blends the sand; distributes the moisture uniformly; increases the permeability and doubly aerates the sand. Molding sand is reconditioned by two portable type machines made by the American Foundry Equipment Co., Mishawaka, Ind. These machines equipped with sets of revolving blades travel under their own power, cut over and aerate the sand and either leave the sand in long windrows or kick it up in piles close to the molding machines in the light work bays, or in close proximity to the flasks laid down on the rollover boards in the main bay.

Lathe beds made in nine different sizes range in weight from 1560 (*Please turn to page* 127)



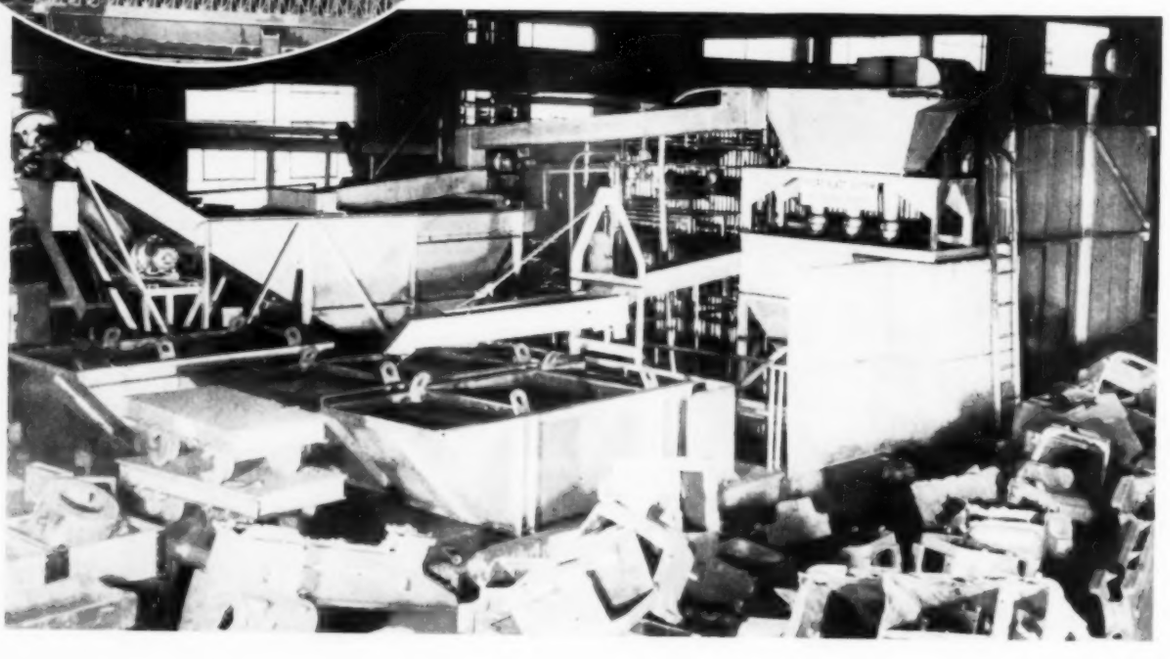


Fig. 12 (Left)—A combined stream of sand and water at high velocity removes cores from castings in fraction of time required by any other method. Fig. 13 (Below)—Overflow combined sand and water from the washer passes through a series of bins where it is drained, dried, classified according to grain size and has the fines removed

Making Nonferrous Test Bars

By N. K. B. PATCH

IN THE discussion of gating castings in other articles which have appeared previously, the specific gating of test bars was not outlined in the detail it properly deserves. Test bars are a specific type of casting which are made in order to represent the characteristics of metal being poured and to permit of two or more tests from a given batch of metal for comparison. Therefore, the method of casting and the design of the bar and the other related conditions must be standardized if two tests from the same pot of metal are to be comparable. That is why the tests on cast metals have been outlined so specifically in government specifications and those drawn by the American Society of Testing Materials and the American Standards Association.

There are those who contend that a separately cast test bar is not a true representation of the casting poured from the same pot of metal and therefore is of little use. They contend that the test bar should be cut from the casting which means that the casting is destroyed for useful purposes and which brings up the question of what part of the casting is to be used for testing and how much difference is there between two bars cut from the same casting, one located at one point, the other at another in the same identical casting.

Moreover, since castings are of irregular shape, varying in thickness and curvature, the question of whether the particular part chosen for testing has been fed properly or not becomes a vital factor. However, a separately cast test bar may be standardized in shape, location of riser, method of gating and other factors so that it becomes representative of the metal when cast under standard condi- (*Please turn to page* 124)

Figs. 47, 48, 50 and 51—Different methods of producing suitable bars to meet physical specifications. Fig. 49—Dimensional standards on machined bars

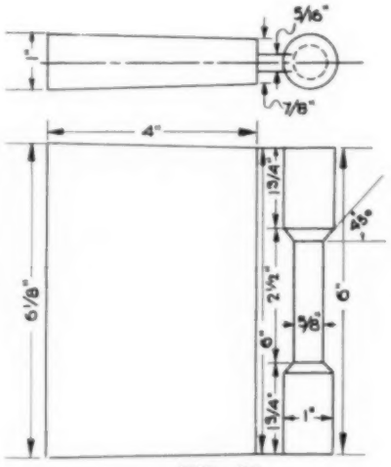


FIG. 47

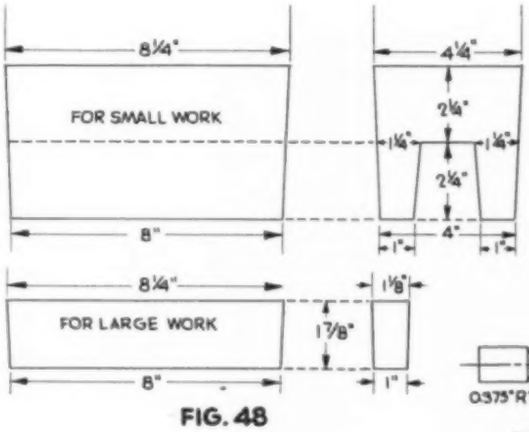


FIG. 48

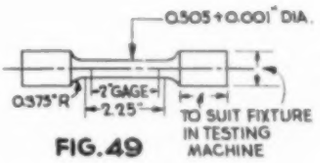
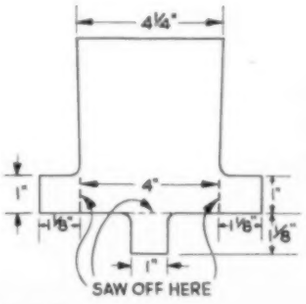


FIG. 49

FIG. 50



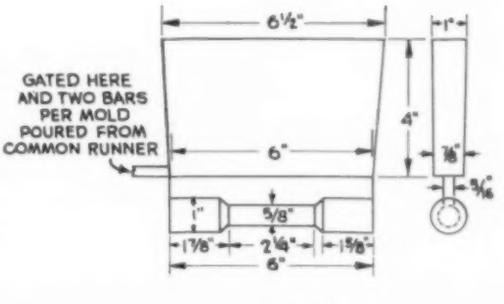
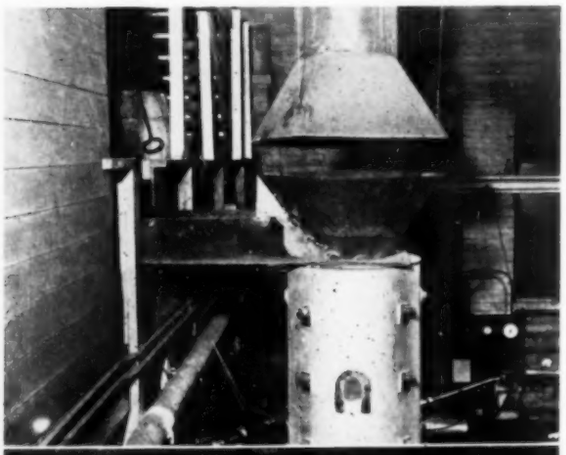
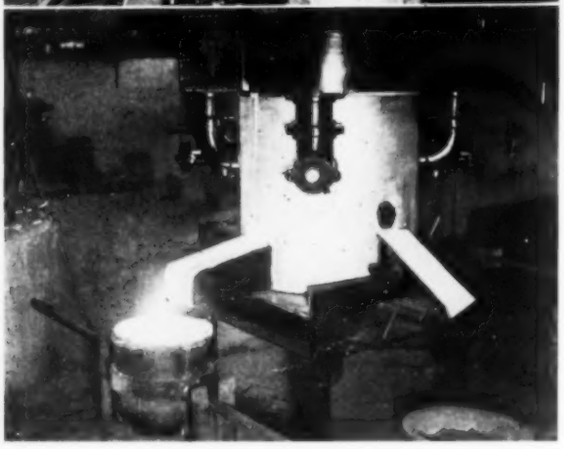


FIG. 51

CONSTRUCTION and OPERATION of a 15-inch Cupola

By FULTON HOLTBY
Assistant Professor
University of Minnesota, Minneapolis





TREND in the cast iron foundry industry in recent years has been toward using smaller cupolas. Advantages of the small cupola probably first were noticed during the recent depression, when many foundries were operating below capacity. Many cupolas being used in industry today are large cupolas which have been lined to make smaller inside diameters. Production foundries introducing continuous pouring systems have found that small cupolas, operating on 8 to 10 hour heats, serve their purpose much better than large cupolas melting the same tonnage in a shorter time.

Educational institutions are likewise finding it desirable to run smaller furnaces and smaller heats for production and instructional purposes. Many safety problems arise when a group of inexperienced college engineering students melt and pour 2 to 3 tons of iron per hour. While trying to keep out of each other's way and still taking time to gaze with awe at their first ladle of molten iron, they miss most of the important cupola furnace operations about which they are supposed to learn.

May Be Taken Apart

The 15-inch cupola described in this article was built by the foundry department at the University of Minnesota for instructional purposes and for cupola research work. It has been in successful operation for a year. It might also be used in industry for melting small amounts of alloy iron. The design is such that it can be taken apart easily, relined or patched in a very short time, and the tuyeres can be lowered or raised readily. In spite of its small size, its overall efficiency is high.

The construction of this cupola is shown in Figs. 1, 2, 3 and 4. The shell is made from 24-inch diameter, 3/16-inch steel hot water tanks. It is made in two parts, separated above the melting zone. The top part, which is 54 inches high, can be easily removed to facilitate patching the melting zone. It is equipped with lifting ears and holes through which a bar can be inserted to help in handling with a crane.

To aid in aligning the two halves of the shell, three bent metal guide strips are welded to the bottom of the top half. A 1½-inch angle iron lining shelf is also welded inside the top half of the shell to support the fire brick lining. A cast iron ring is placed on the top of the shell to protect the brick lining from becoming broken.

The lower half of the shell, containing the

Fig. 1 (Left above)—Top of cupola showing charging chute, charging funnel and hood. Fig. 2 (Left)—Bottom part showing general construction. Photo taken during second tap of cast iron

Table I

Charges for 15-inch Cupola

Steel Per Cent	Fuel Ratio	Coke lbs.	Steel lbs.	Scrap lbs.	Pig lbs.	Limestone lbs.
0	10-1	15	0	120	30	3
20	9-1	15	27	77	30	3
40	8½-1	15	51	47	30	3
60	8-1	15	72	18	30	3

Coke size 2½ x 2½ x 3 inches. Limestone size 1 x 1 x 1 inch. Metal size 5 inches maximum.

melting and crucible zone, is 50 inches high and is welded to the bottom plate. The bottom plate is a ⅜ x 30-inch square steel plate welded to the two horizontal I-beams which support the furnace. Hinged to the bottom plate are the cast iron bottom doors, perforated with ¼-inch holes.

The legs are 4-inch standard steel pipe, 21 inches high and welded to the I-beams. For horizontal side members of the frame, two 30-inch lengths of 3-inch angle iron are welded to the top of the bottom plate, connected to the I-beams and the legs with corner pieces of ⅜-inch steel plate. A sprinkler system is provided beneath the bottom plate for quenching the drop.

Horseshoe Shaped Wind Belt

The wind belt is horseshoe shaped, located entirely above the tuyeres and approximately opposite the melting zone, and is made from ⅛-inch steel. Sets of downcomers of different lengths are provided so that the height of the tuyeres can be adjusted. Four bolts are used to hold each flange connection and rubber gaskets are inserted to make them airtight.

Bronze castings equipped with mica peep-holes and sheet aluminum safety plugs connect the downcomers to the four tuyeres. The tuyeres themselves are 3½-inch steel pipe nipples threaded into the tuyere connections.

The crucible capacity is determined by the height of the tuyeres. The drawing, Fig. 3, shows short downcomers and the location of the slag-hole for a crucible capacity of 200 pounds of iron. The effective height of the cupola, or the distance from the top of the tuyeres to the charging door, is 85 inches for the position of the (*Please turn to page* 114)

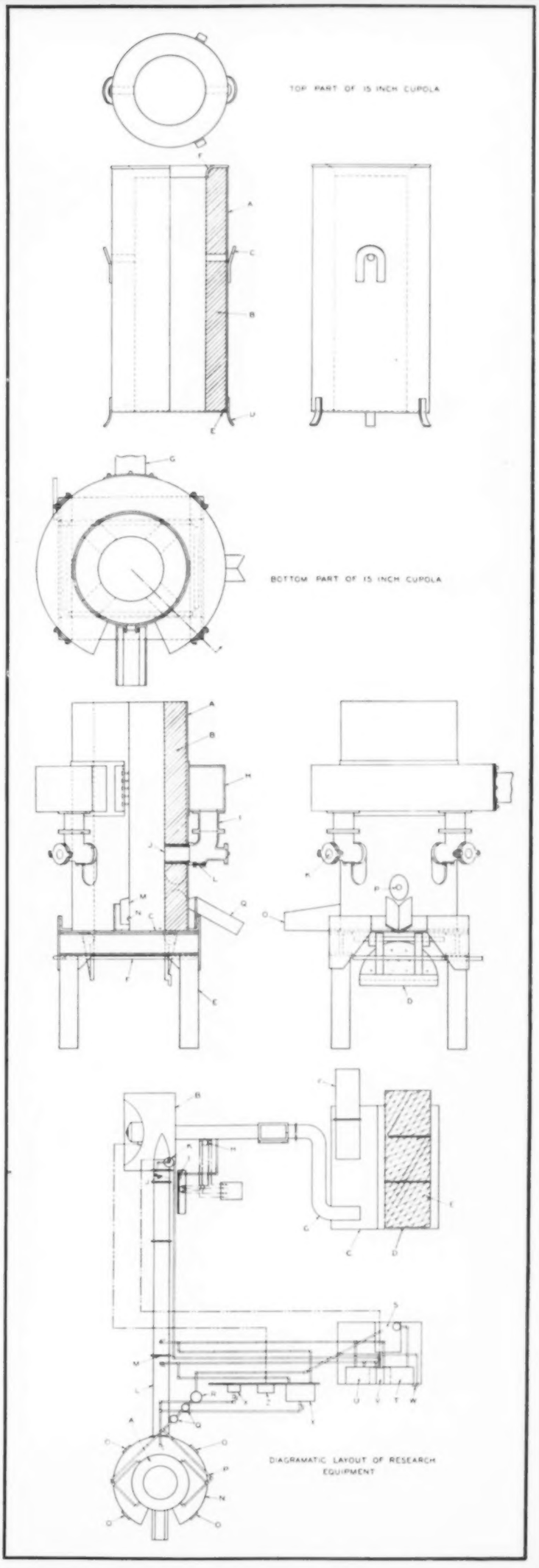


Fig. 3 (Top right)—Top part of cupola with shell A, lining B, lifting ears C, guide strips D, lining shelf E, and top ring F. Fig. 4 (Center right)—Bottom part with shell A, lining B, bottom plate C, bottom doors D, legs E, sprinkler F, blast pipe G, wind belt H, downcomer I, tuyeres J, peep holes K, safety plugs L, breast M, taphole N, tapping spout O, slag hole P, and slag spout Q. Fig. 5 (Right)—Diagrammatic layout of cupola research equipment

Circuit Teaching Carries to Small

By

GEORGE A. ZABEL

Circuit Foundry Instructor
Wisconsin Schools of
Vocational and Adult
Education

Foundry Instruction Communities

OLD ideas applied to new situations is the difference between the way things were done yesterday and the way they are done today. In many cases modernity is the reapplication of ideas already known. In the foundry, for example, the basic ideas behind the modern sandslinger were derived from the old idea of throwing sand into the mold from the hand of the molder, to give special compactness in pockets, corners, around soldiers and gaggers.

Apply Old Ideas in New Way

Likewise, the fact that mulled sands are stronger than cut-over sands was learned early by the "old timer" who invariably used the sand that fell by the flask when ramming up the drag for making the cope. He knew the tramped sand around the drag was strong and when used for ramming up a cope was less likely to give trouble from drops, washes, cuts, etc. Reapplied to machinery, the work of the molder's feet gave way to the modern sand muller which does the work uniformly better and gives additional desirable characteristics to a foundry sand other than strength. Reapplication of old ideas leads to improvement, and efficiency.

Reapplication of educational ideas and the means of disseminating education has taken place too. One of the first methods of spreading education was through the medium of traveling teachers, such as missionaries. It was the means of bringing education to those remote from educational centers. Traveling preacher-teachers, coming in contact with the inhabitants of out-of-the-way communities, in our early history, were indispensable to the unified growth of our country. Traveling on foot, by horseback, by wagon, their early modes of travel were slow and cumbersome. Bringing this quickly up-to-date, instructors in specialized fields such as foundry practice, in some states, now reach even the smallest communities by automobile.

Traveling instructors of foundry practice? Yes! The idea is not new, but the situation is. Shortly after the first World war, the German nation inaugurated a system of education designed particularly for its workers. The means of spreading this education was based fundamentally on the older forms of traveling teachers, but was reapplied to modern situations. Educational equipment in several trade fields was set up in railway cars. Each car was transported to an industrial center where a particular type of industrial education was needed.

The instructor traveled with his equipment. When the designated course was completed in one locality, the car was again picked up and taken to another industrial center, and thus expert educational service in several trade fields was offered to the workers all over Germany.

Instructors Travel Over Country

The German idea reapplied to suit the needs and conditions in the state of Wisconsin has resulted in what is now known as the circuit teaching movement—a method of giving educational opportunities to all workers through the means of traveling trade-competent instructors, who travel from city to city by automobile.

For more than 15 years now the circuit teaching movement in Wisconsin has been carried on, based on the underlying principle that a nation is as strong internally and internationally as is the strength of its working man power. The movement is based on the philosophy that to have a strong working man power, that man power must be trained continuously, and must be given access to such training as will make it useful immediately in times of national emergencies such as we are experiencing at the present time. The purpose is to have the working man power ready at all times.

The circuit teaching movement in Wisconsin is the inspiration of Dr. George P. Hambrecht, state director of adult and vocational education, who, during an inspection trip of European educational facilities for workers, saw in the educational practices of the German nation in the early twenties the possible culmination of a strong industrial nation.

As the result of Dr. (*Please turn to page* 106)

Various views taken in classrooms and in the foundry. The author is shown in the central inset

QUESTIONS and ANSWERS

Segregation in Drain Casting Results From Several Causes

We are sending you two brass drain castings for determination of the cause of segregation. For this line of plumbing fixtures, we use remelted scrap, and in no other castings ever have encountered difficulty. We use No. 1 Albany sand; this was made wholly in green sand, metal poured about 2200 degrees. Is this trouble not caused by excessive moisture? Ring castings of about one-half inch section were cast from this same crucible, and proved to be perfect in machining.

The defect shown in these castings is something that we have seen many times and we believe it is caused by one or more of several different conditions. Sometimes only one is necessary to cause it and sometimes a combination of two or more. Excessively wet sand tends to chill the surface of the casting suddenly forcing the gases thus set free toward the inner portion of the casting that is still molten and finally freezing there in the form of tiny bubbles, making the casting split at the point of the concentration of these bubbles.

Improper gating that will result in the development of this dividing line is also a cause; but you will see from the above that both of them come back to the fact that gases released upon solidification of the metal are forced into the inner part of the casting. These gases are the ones absorbed during the melting from the presence of underburnt gases, resulting from improper combustion of fuel.

One reason why you do not find trouble from these gases in other castings poured from the same pot, is that they are forced from the casting as it solidifies into the gates and sprues, which are of sufficient size to stay molten after the casting has set.

Where the amount of gas is very small, it really does not develop much of any trouble excepting when it is concentrated by the gradual development of increased content toward the center of the casting by reason of the rapid cooling of the outside surfaces and consequent forcing of the gases toward the inner section as exemplified in the defects in question.

We do not believe that this metal is excessively gased but we do believe that your gating is such that it accentuates the difficulty and had these castings been produced so that the cooling took place in a different way, you probably would have had no trouble. Although there might have been some occasional minor imperfection.

It is well, in this class of casting, to work the sand fairly dry. The moisture content should not be above 6½ to 7 per cent. A reasonably dry molding sand and gating that will develop the right flow of metal into the mold to insure a cooling of the casting in a proper way, will correct your difficulty. In fact, we are quite sure that you are not having a great many of these at present and they crop up only when your sand is wet or when the temperature of the metal at the moment it is poured is such that the cooling condition is just right to develop the conditions described in the first part of this answer.

We believe that you will get much better results if you have these castings with the flange down and enter the metal from two or more gates into the flange and let it rise quietly up into the body of the casting and be assured thereafter you will have very little trouble.

Bed in Small Diameter Cupola Should Be Much Higher

Our cupola 27 inches diameter inside the lining receives blast from a No. 7 fan driven by a 5 horsepower motor and running at 1700 revolutions per minute. Pulley on the motor is 4¾-inches diameter. Pulley on the fan is 8 inches diameter. The blast pipe is 11½ inches diameter for a short distance and then is divided into two 6-inch diameter branches leading to the top of a wind belt 6 x 30 inches. Blast enters the cupola through four 4-inch diameter tuyeres 12 inches above the sand bed. The coke bed extends 11 inches above the tuyeres and the charges consist of 400 pounds of scrap and 50 pounds coke. The charging door is 12 feet above the sand bed. The iron comes cold and chills quickly. We shall appreciate your opinion on how to improve conditions.

Your practice differs so widely from the practice usually observed by cupola operators that we do not wonder the iron is cold and sluggish. Under the conditions outlined we would not expect to see iron with enough life to run through the tap hole. The fan is running at only about half the required speed, the tuyeres are too small and the bed is too low. The fact that you are melting all scrap charges accounts in

some measure for the sluggish and quick freezing metal. Without entering into all the metallurgical features involved, it is sufficient to refer to the well known fact that each time scrap is melted it loses some of its *life* or fluidity.

Our suggestion is to increase the speed of the fan by setting up a jack shaft with two pulleys, one 6 inches diameter belted to the motor and the other 20 inches diameter belted to the fan; cut four additional tuyere openings in the cupola shell and raise the coke bed to at least 30 inches above the tuyeres at the time charging commences. Raise the silicon content of the iron by the addition of 1 to 4 pounds 50 per cent ferrosilicon in each 400 pounds of scrap. The exact amount will depend on the character of the scrap.

Presumably you make light machinable castings in which the silicon content should be approximately 2.25 per cent in ½ to 1-inch sections and higher in thin sections. If your heat runs over an hour, throw a shovel full of limestone, about 20 pounds, on each charge and draw off the slag through a suitable slag hole at the back of the cupola. A 27-inch cupola has a melting capacity of 5700 pounds per hour and requires 1150 cubic feet of air per minute.

Cast Iron Doors with Center Grating Crack in Corner

We make a cast iron door in several sizes, the largest 17 x 22 inches. Part of the door is a grating. The intermediate sizes give no trouble, but the largest and smallest sizes crack at one corner. We pour several doors from one ladle. One or two will crack and the remainder are perfect. The cupola charge is one-third pig iron and two-thirds mixed scrap. Analysis of the pig iron shows silicon 2.42 per cent, sulphur 0.024 per cent, phosphorus 0.45 per cent, manganese 0.77 per cent.

Design of the door is responsible for the crack in the corner. The thin grating in the center sets first and prevents the outer part from contracting in a normal manner later. The doors that do not crack are in a state of tension and may crack shortly after they go into service and that will do your reputation more harm than the doors which crack in the shop. Since designers and customers are extremely reluctant to change a design, the foundryman has to find a way to get around one of the natural laws. If only one or two castings were involved he might strip the center and pour some hot iron over the grating. That would equalize the cooling speed.

However, that is not a practical solution where a considerable number of castings are on the floor. The practical remedy, one that is employed in nearly all cases of a generally similar character is to increase the silicon content of the iron. This softer iron will give or stretch a little in cooling. The iron as it is now will not show more than 2.20 or 2.25 silicon. It should be raised to at least 2.50 per cent. Methods of securing this result include addition of silvery pig iron or silicon briquets in the mixture. Where only small amounts are involved, powdered ferrosilicon may be poured into the cupola spout and incorporated with the stream of iron as it runs into the ladle.

Sand Sticking to Castings May Be Due to Metal Composition

We are operating a small nonferrous foundry and recently have had trouble with sand sticking to the castings, particularly on the bottom of castings placed horizontally in the molds, and on long bushing sticks cast vertically. We use a gas-fired furnace with a No. 60 crucible, and the mixture is 135 pounds scrap bronze, 76 pounds copper, 11 pounds tin, 2½ pounds lead, and 2½ pounds zinc. We have tried changing moisture, sands, gating, and pouring without results.

The difficulties you describe are more or less typical of castings with high lead and tin contents in the composition. Are you sure that your scrap is not increasing your lead content? You assume that you have a 2½ per cent lead content with a 11 per cent tin content. Possibly you are getting more like a 5 per cent lead content with 11 per cent tin in which case the pouring temperature could be lowered materially from that which you are now using, particularly when the castings are heavy.

Furthermore you do not mention the use of phosphor-copper or phosphor-tin but without doubt you are using some phosphorus. In the presence of as much tin as you describe the lead-tin alloy in the presence of phosphorus is very fluid and will settle to the bottom of the mold and cause tin sweating. It also will seek out and fill the cavities between the different grains of sand making the ugly skin of which you speak.

The casting surface will show sand adherence and if you examine the sand it will be found to contain some of the lead-tin compound or lead itself. This is the material that holds the sand to the casting. To correct your difficulty be more careful about the chemical analysis of the alloy you are melting by abandoning the use of scrap. Buy composition ingots from reputable sources. By melting those ingots by the method you describe you should have little or no trouble with tin sweat. If you have no tendency to tin sweat you will have no trouble with the same adhering to the castings unless you pour the metal too hot.

A little experiment as to the temperature at which to pour it will pay you dollars in saving kicks from customers. Obviously where a casting is heavy it must be poured a little colder than that casting which is light and chills promptly. Otherwise the mass of heat that is stored up in the casting will be sufficient to burn into the sand in the manner you describe. You may find it desirable to flour your molds with a light coating of foundry flour. This burns on the entrance of the hot metal into the mold cavity and forms a layer of smoke on which the first metal lays and sometimes avoids the tendency to have the metal burn in.

If that is not effective and you still have pressure enough to force the metal into the cavities between the sand grains a coating of the mold with graphite will be found to be helpful. This is particularly desirable with large castings of heavy section in which the difference in height between the high and low points of the mold is sufficient to set up quite a pressure against the face of the mold.

Equipment To Clean Brass Castings

We use an octagon shaped tumbling barrel to clean our brass castings with sand and water, but the results are not satisfactory. The castings are not clean. Can you suggest a better method for using the tumbling barrel, a solution that will give better results than sand and water, or an alternative method for cleaning the castings?

Since the wet type tumbling barrel is used satisfactorily in many installations, we are inclined to the opinion that your molding sand and not the tumbling barrel is the link in the chain of production that requires attention. A properly refractory sand will strip readily from the castings. A minimum amount of treatment in the tumbling barrel should remove remaining small patches of sand. Where the sand is not sufficiently refractory, a thin coating will stick to practically the entire surface of the casting. Castings produced under these conditions will tax the capacity of any type of cleaning unit.

You do not state to what extent you have experimented with packing methods and time schedules on the octagon barrel. Possibly, the material is not packed closely enough, or it may be that the mill is not operated for a sufficient length of time. Both of those features will bear investigation. In the advertising section of THE FOUNDRY you will find the names of manufacturers and descriptions of devices for cleaning castings with sand or metal abrasive. One type employs compressed air for throwing a constant stream of abrasive against the surface of the castings. In a second type of machine the abrasive is thrown mechanically. The machines are available in a wide variety of sizes, designs and capacities.

Bars Do Not Stand Up in Service

We have had complaints from a customer that our grate bars are not standing up in service. The bars are in a dutch oven furnace burning saw dust and hog fuel, wood broken into small pieces about the size of a nut. We melt scrap iron charges in the cupola and produce soft gray iron. We have a wide variety of scrap including cylinder blocks and car wheels and can make up practically any type of mixture. We shall appreciate your advice on what kind of scrap we should use, also what other ingredients would give greater heat resistance qualities.

Ordinary gray iron makes fairly satisfactory grate bars. While a customer some times is justified in complaining, the foundryman would do well to investigate firing conditions at the customer's plant, before accepting the complaint and placing all the blame on the iron. Under proper conditions cold air passes up through the grate openings. The bars are kept in a comparatively cool condition with the exception of the upper surface immediately in contact with the heated fuel. Where clinkers are allowed to accumulate the passages are closed. The grates become red hot and eventually warp, grow, and burn out.

The same situation exists where hot ashes are allowed to accumulate under the bars. Ashes prevent radiation and the bars fail rapidly. Typical analysis of ordinary grate bar iron shows: Silicon 2.00 per cent, manganese 0.60 per cent, sulphur 0.05 per cent, phosphorus 0.20 per cent, total carbon 3.50 per cent. An alloy gray iron used in grate and stoker parts contains: Total carbon 3.30 per cent, silicon 1.50 per cent, manganese 0.60 per cent, nickel 1.50 per cent and chromium 0.60 per cent. Another composition contains 1.75 to 2.25 per cent silicon, 0.50 to 0.80 per cent manganese and 0.85 to 1.25 per cent chromium. The cupola charge usually contains from 15 to 30 per cent steel, amount depends on the size and shape of the casting, and to some extent on the character of the other component parts of the charge.

Book Ends Must Be Colored Brown

We have a customer who desires a bronze to be used for book ends which will take a rich, dark brown color to be applied chemically. What would you suggest for the alloy?

Since ornamental castings such as book ends, etc. are subjected to rather difficult finishing operations, they usually are cast from compositions that are soft, and can be finished by hand operations. A good alloy for the purpose is the usual 85-5-5-5 alloy, but to make it soft and easily machinable many founders reduce the tin and zinc content giving a composition with 89 per cent copper, 3 per cent tin and zinc each and 5 per cent lead. The alloy takes chemical coloring effectively. Some desire a stiffer material for reproducing delicate structures, and use an alloy containing more zinc similar to that containing 85 per cent copper, 3 per cent tin, 5 per cent lead and 7 per cent zinc.

You are aware that candlesticks and other ornamental castings are made from yellow brasses containing from 3 to 5 per cent lead so that they are readily machinable. However, they do not always color readily, particularly the dark liver color you mention. While there are a variety of solutions for obtaining a brown color on high copper alloys, the most simple is that containing about 1 ounce of potassium sulphide dissolved in 1 gallon of water. Shades ranging from chocolate brown to black may be secured by variations in temperature of the solution, and period of immersion. Light browns are obtained with normal temperature and short immersion. Darker colors appear with hot solution and long immersion. Final finish is attained by scratch brushing dry with a fine steel wire brush and lacquering.

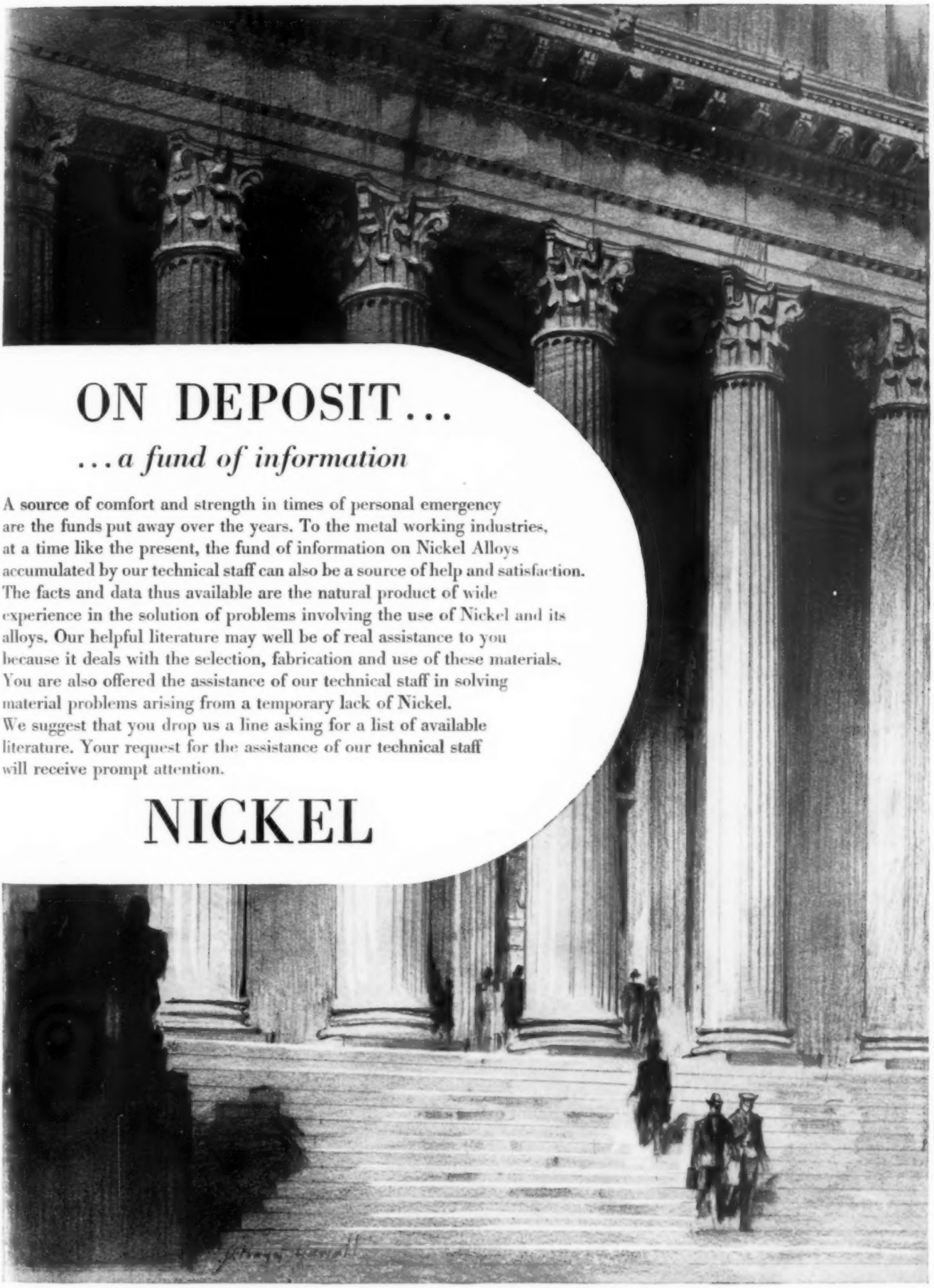
Hard Edge on Plate Causes Trouble

We have had trouble with hard edges on an oval, flat iron plate about 12 x 20 inches and 1¼ inches thick. Casting is made on a jolt rollover machine in silica sand where the moisture should not be too high. Numerous small gates are employed to fill the cavity rapidly and no risers are used. Analyses of metal from hard and softer sections show the same composition of 1.82 per cent silicon, 0.69 per cent manganese, graphitic carbon 2.93 per cent, total carbon 3.50 per cent, phosphorus 0.40 per cent, sulphur 0.106 per cent and chromium 0.06 per cent. We ram hard and sand permeability has been on the low side so we can get a smooth casting to eliminate as much grinding as possible. Can you give us some causes of hard spots?

The information you give on your plate casting does not give any clue as to the cause of the hard spots. On the contrary, one would expect from the composition, etc. that the iron would be reasonably soft, tending toward an open grain iron. Usual causes of hard spots are composition; excess moisture, particularly if a swab is used; hard ramming on corners and high parts of the pattern; tramp iron in sand; poor joints in mold permitting formation of thin fins; shaking out too soon; and low pouring temperature. You do not mention how the hard spots are determined, but presumably it is through machining.

Cases have been found where the difficulty of hard spots as they were termed actually were just the opposite. The trouble was caused by soft spots which permitted the tool to dig deeper and chatter when it struck the slightly harder metal forming the main body of the casting. Hence, it is suggested that you look into the matter a little more closely to see whether the

(*Concluded on page* 74)



ON DEPOSIT...

...a fund of information

A source of comfort and strength in times of personal emergency are the funds put away over the years. To the metal working industries, at a time like the present, the fund of information on Nickel Alloys accumulated by our technical staff can also be a source of help and satisfaction. The facts and data thus available are the natural product of wide experience in the solution of problems involving the use of Nickel and its alloys. Our helpful literature may well be of real assistance to you because it deals with the selection, fabrication and use of these materials. You are also offered the assistance of our technical staff in solving material problems arising from a temporary lack of Nickel.
We suggest that you drop us a line asking for a list of available literature. Your request for the assistance of our technical staff will receive prompt attention.

NICKEL

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

(*Concluded from page 72*)

trouble is hard spots or soft spots.

If the difficulty actually is hard spots, you may be able to overcome it by the addition of a small amount of nickel or ferrosilicon graphite to the ladle. In the case of ferrosilicon, it is suggested that you reduce the silicon content in the entering charges so that the iron at the spout contains about 1.50 per cent. Then the 0.30 per cent or so remaining is added in the ladle about 2 minutes before pouring and stirred well.

Alloy Is Not Too Hard To Handle

We would like to have some information on casting gun bronze of the 88-10-2 composition. We have a coke-fired pit furnace with natural draft and cast considerable red brass every day, but could get some nice bronze work if we were sure we could handle it. We have noticed references in THE FOUNDRY to reducing atmospheres, and would like to know how to control the atmosphere in a coke furnace. Is there a good book on the subject?

Handling of the 88-10-2 alloy is quite similar to that of red brasses except that the melting point is somewhat different. It is a bronze since the tin content predominates in the white metal content. It is quite fluid at the pouring temperature, and requires suitable risering to insure proper feeding. The latter does not require much experimenting, and you should have no difficulty in determining the proper riser size and location.

To have the right furnace atmosphere in a coke fired furnace, be careful to see that the most rapid melting conditions prevail. Do not try to use too large a crucible or you will have inadequate fuel which will retard melting. Unless melting is fast the molten metal is exposed for long periods to the furnace gases which are absorbed. With fast melting it is reasonable to suppose that an adequate supply of oxygen is available, and that the furnace atmosphere is on the oxidizing side—the correct condition to avoid gassing the alloy.

See that the flues are clean as well as the grates so that nothing retards the free flow of air through the furnace, and maintain that condition at all times. Do not pack the coke down too tight as that will slow down burning. Do not have the metal extend above the top of the crucible at the start of melting to prevent gas absorption. Bear in mind that the metal does not have to be molten to absorb gas. One book which deals more specifically with the 88-10-2 alloy is *Metallurgy of Bronze*, by C. H. Dews which is available for $3.75. It does not discuss molding, but is devoted to the metallurgical phases.

Want Rough Face on Plaque Casting

We shall appreciate information on several features in connection with casting bronze plaques. The facing sand is made up of 20 parts heap sand, 20 parts new Albany sand and 1 part rye flour. The face is sprayed with molasses water and skin dried. The letters occasionally wash. How do we secure a slightly rough or mat face on some of these castings. We have been told to place cloth on the face of the pattern, or to cover with rough glass.

Your method of making plaque molds conforms to usual practice. Washing of some of the letters occasionally may be due to one of two causes. The small mounds of sand may be loosened either in rolling the drag over, or at the time the pattern is removed. This point may be determined by a close examination of the face of the mold before it is sprayed. The second reason may lie in the facing sand. It may be too weak. However, since the defect appears only occasionally, the second cause needs hardly any consideration.

You can secure a harder and firmer face on the drag side of the mold by omitting the old sand from the mixture. Cover the pattern with all new sand facing bonded with flour or any other core binder. Wet the sand with thin clay wash or molasses water. Spray the surface with molasses water, 1 pint to a gallon, and skin dry the mold. A charcoal fire is the best, but a gas or oil torch handled intelligently will produce satisfactory results. Obviously if the sand is burned at any point it will wash when it is struck with the stream of metal.

Molds may be skin dried in the oven, but this is the least satisfactory of the several methods, particularly if wood flasks are employed. Unless close watch is kept and unless the temperature is closely controlled, the flasks will warp, twist, crack or scorch. Even with an iron flask the heat penetrates too far and brings up steam. The rough or mat surface on the casting is produced by covering the face of the pattern with bookbinder's cloth. The cloth is pressed into place on a newly shellacked surface. The letters of course also are attached to the face of the pattern with shellac. Subject of plaque and tablet molding and casting has been covered on many occasions in THE FOUNDRY. For example see a series of five articles, September, October, November, 1934 and February, 1935 on the use of plaster patterns.

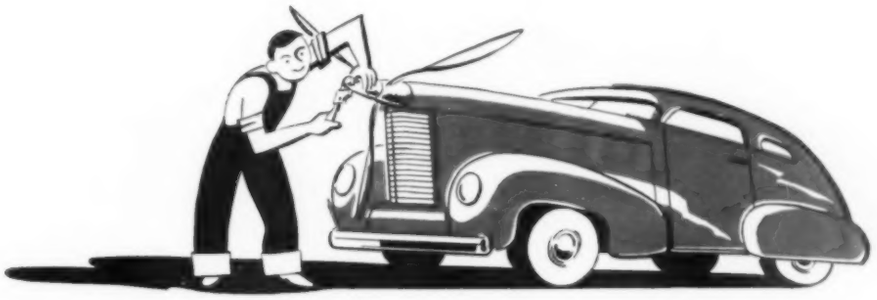
Large Mold Yields Under Pressure

We find dirt and shrinkage cavities in the top flange of a gate frame casting approximately 8 x 10 feet and 4 feet deep. The mold is constructed in dry sand cores assembled in a pit in the floor. The 9-ton casting is poured from two ladles at opposite ends of the mold. The sprues extend to the bottom and the metal enters through gates in the bottom flange and through additional gates in one of the ribs about half way between the top and bottom. We provide several side risers on the top flange, also ½-inch extra metal for finish. We are thinking of adding 2 inches extra metal to the top flange and pouring the casting without a cope. We shall appreciate your opinion on our gating system, also on our proposal to cast the mold with an open top.

The most probable cause of your trouble with the gate frame is a mold which yields under pressure and a set of cores from which the vent does not escape as readily as it should. Gas from the cores causes the metal to boil as it rises in the mold. Violent action promotes formation of scum which rises and lodges in the upper flange. Shrinkage is caused by a mold which is not sufficiently rigid to withstand the static pressure of the metal. You can check this theory by measuring the thickness of metal. If you find that the mold has strained an appreciable amount, you will know that no method of gating or manipulation of the top flange will prevent the formation of shrinkage cavities. Consequently, it will be necessary to do your molding in a pit with concrete, cast iron or steel walls which will not yield under pressure of the metal.

On many types of molds formed in cores the green sand rammed in a pit in the floor is sufficient to hold the cores in place. On an exceptionally deep mold where the metal enters at or near the bottom, the mold will strain or spread to some extent. This occurs just about the time the mold is filled with metal. As the mold yields the metal sinks all the way through. Your proposal to add 2 inches to the flange is feasible, but it means a great deal of machine work and besides the metal in the center of a 4 or 6-inch section is not as close grained and strong as metal that requires only a light finishing cut. Our suggestion is to reduce the core binder to a minimum and provide extra channels for free exit of the gas. Assemble the cores inside a cast iron, steel or concrete pit where they can be braced solidly from the wall inside and outside. We believe that procedure will eliminate the trouble.

HOW TO GET more speed OUT OF your foundry



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JJ-41

MEN OF INDUSTRY

JOHN VICKERS recently joined the Gray Iron Founders' Society as special representative. He will assist W. W. ROSE, executive vice president, in the field. Mr. Vickers served as an apprentice at the Illinois Steel Co., South Chicago, Ill., from 1910 to 1911 and graduated from Cornell University in 1916 in mechanical engineering. Other work carried him into the DuPont Powder Co., Standard Oil Co. of Pennsylvania, General Motors Corp. and other firms, his time divided between manufacturing operations and sales. Mr. Vickers served overseas in the first World war as ambulance driver with the American Field Service in the French Army, and as a pilot with Britain's Royal Air Force.

♦ ♦ ♦

CHARLES J. SCHECKHAUS, foundry superintendent, Union Spring & Mfg. Co., New Kensington, Pa., has been elected president of the Pittsburgh Foundrymen's Association. Last year Mr. Scheckhaus served as chairman of the membership and attendance committee of that organization.

♦ ♦ ♦

T. J. DONLAN, recently appointed foundry superintendent Standard Foundry Co., Racine, Wis., served his time at the Murray Iron Works, Burlington, Ia. From 1920 to 1929 he was superintendent Fuller & Sons Mfg. Co., Kalamazoo, Mich., and later served in the same capacity with the Beckwith Co., now known as the Round Oak Heating Co., Dowagiac, Mich. For the past 10 years he has been foundry superintendent Odin Stove Mfg. Co., Erie, Pa.

♦ ♦ ♦

W. E. JOMINY, formerly research metallurgist, General Motors Research Laboratories, Detroit, and well known in metallurgical circles for his work in connection with hardenability tests on steel now is associated with the engineering department of Chrysler Corp., Detroit, working as metallurgist under direction of F. E. MCCLEARY.

♦ ♦ ♦

R. L. MCILVAINE recently has been appointed to the engineering staff of the National Engineering Co., Chicago. Mr. McIlvaine has a broad background of foundry experience, both in foundry engineering and foundry operations. He attended the University of Illinois, where he majored in mechanical engineering and graduated in 1925. The year following graduation he was cupola foreman, Griffin Wheel Co. From 1926 to 1930 he was associated with his father as foundry engineer, R. W. McIlvaine Co., which company pioneered the mechanization of foundry operations. From 1930 to 1941 he acted as president of McIlvaine Foundry Conveyors Co. Inc. In 1933 he became associated with Swayne Robinson Co., Richmond, Ind., as chief engineer and sales manager, which position he held until he joined the National Engineering Co. Mr. McIlvaine is a member of the American Society of Mechanical Engineers and the American Foundrymen's Association.

♦ ♦ ♦

DR. N. E. WOLDMAN, chief metallurgical engineer, Eclipse Aviation division, Bendix Aviation Corp., Bendix, N. J., recently has been elected chairman of the Metropolitan Chapter of the A. F. A. Dr. Woldman was born July 22, 1899 and attended Western Reserve university, Cleveland, from 1916 to 1918. He obtained a bachelor of science degree in chemical engineering from Case School of Applied Science, Cleveland in 1921, and in 1922 received a master of science degree in chemical engineering from Ohio State university, Columbus, O. The following year he became an instructor of electro and physical chemistry at the University of Maine, and from 1923 to 1924 he was an instructor in metallurgy at the University of Illinois. After receiving a degree of doctor of philosophy in chemical and metallurgical engineering from Columbia university, New York, Dr. Woldman was professor and head of the department of chemistry and metal-

(*Continued on page* 78)

Dr. N. E. Woldman

John Vickers

Charles J. Scheckhaus

R. L. McIlvaine

Vital to Today's Rush Foundry Schedules

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America's Largest Completely Integrated and Independent Merchant Iron Producer

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(*Continued from page* 76)

lurgy, U. S. Naval Academy postgraduate school, Annapolis, Md., from 1925 to 1929. He became research and metallurgical engineer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., in 1929, serving as well as professor of metallurgy in the evening extension school, Carnegie Institute of Technology, Pittsburgh during 1931 and 1932. In 1935 he became connected with the U. S. Naval Gun factory, Washington, as senior materials engineer, and in 1936 accepted his present position with the Bendix corporation. Dr. Woldman has written considable for the technical press, and in addition to being a lieutenant commander in the U. S. Naval Reserve, holds membership in the American Society for Metals, New York Academy of Sciences, American Association for the Advancement of Science and the American Foundrymen's Association.

♦ ♦ ♦

JAMES MACBETH JR. recently has been appointed manager of pig iron sales and B. E. STEWART has been appointed manager of by-product sales, Jones & Laughlin Steel Corp., Pittsburgh. The two new managers succeed the late M. W. St. John. All of Mr. McBeth's business experience has been with Jones & Laughlin, having started with the company in the order department in 1915 after attending Carnegie Institute of Technology. A year later he was transferred to the wire sales department, and after a year in the United States army returned to Jones & Laughlin. He worked for a short time in both the Philadelphia and Washington district sales offices and later in 1919 returned to Pittsburgh to the by-product sales department. B. E. Stewart has been head chemist of the by-product laboratory of the Aliquippa works since 1937. A graduate of West Virginia university, Mr. Stewart was chemist for the Consolidation Coal Co. from 1930 to 1933. He left them to go with the Northern West Virginia Coal Operators Association as chemist from 1934 to 1937. He is a member of the American Chemical Society and the Eastern United States Blast Furnace and By-Product Coke Association.

♦ ♦ ♦

V. A. CROSBY, metallurgical engineer, Climax Molybdenum Co., Detroit, has been elected chairman of the Detroit Chapter of the A.F.A. Mr. Crosby is a native of Mississippi and a graduate of the state university with a bachelor of science degree in chemistry. Following his graduation in 1916, he entered the employ of Dodge Bros. Co., Detroit, automobile manufacturers, and a year later entered the U. S. Army as second lieutenant to serve during the World war. After he was relieved from duty, he became associated with the Packard Motor Car Co., Detroit, as foundry metallurgist and later as chief metallurgist. He resigned that position to become foundry metallurgist, Studebaker Corp., South Bend, Ind., where he served for 12 years. In 1934 he assumed his present position with the Climax Molybdenum Co.

♦ ♦ ♦

FRANK REVELL and ERWIN L. GEHRKE have joined the staff of sales engineers, Foxboro Co., Foxboro, Mass., with headquarters located at the company's New York office.

♦ ♦ ♦

JOSEPH MARSHALL, for many years general foundry superintendent of foundries of the Milwaukee road, just has retired upon reaching the retirement age under the railroad act. On June 23, department heads of the Milwaukee Road shops at West Milwaukee tendered him a testimonial dinner at the K. P. Hall in Milwaukee at which tribute was paid to his accomplishments in the foundry industry. Mr. Marshall attracted wide attention throughout railroad circles of the country by his success in making car wheels. He was one of the first to produce them successfully through use of only old wheels and scrap. For the past 25 years Mr. Marshall has been consulted frequently on foundry problems by foundrymen in the Middlewest.

♦ ♦ ♦

PAUL FIELDEN has been appointed director of purchases, Norton Co., Worcester, Mass. Mr. Fielden has been connected with the company 21 years as assistant credit manager. JOHN MILLER, for a number of years assistant credit manager of Norton Co., succeeds Mr. Fielden as credit manager. MARCUS W. WHITE, retains the position of purchasing agent, a position he has held with the company for many years.

♦ ♦ ♦

GERALD F. ELLIOTT, for many years with the American Radiator Co., Buffalo, has been appointed sales engineer in the refractories division, Cleveland Quarries Co. Mr. Elliott's territory will comprise foundries in the Eastern part of the United States and he will specialize in the installation of stone linings in gray iron cupolas.

♦ ♦ ♦

L. W. WALLACE, director of engineering and research, Crane Co., Chicago, recently was elected chairman of the Industrial Research Institute at the institute's meeting in Pittsburgh. Mr. Wallace succeeds H. EARL HOOVER, vice president, Hoover Co., Chicago. C. G. WORTHINGTON continues as secretary of the institute.

♦ ♦ ♦

EDWARD A. BACON, formerly president of the Smith Steel Foundry Co., Milwaukee, recently has been elected chairman of the board of directors. Fred V. Gardner was elected president to succeed Mr. Bacon. Included on the company's

(*Concluded on page* 80)

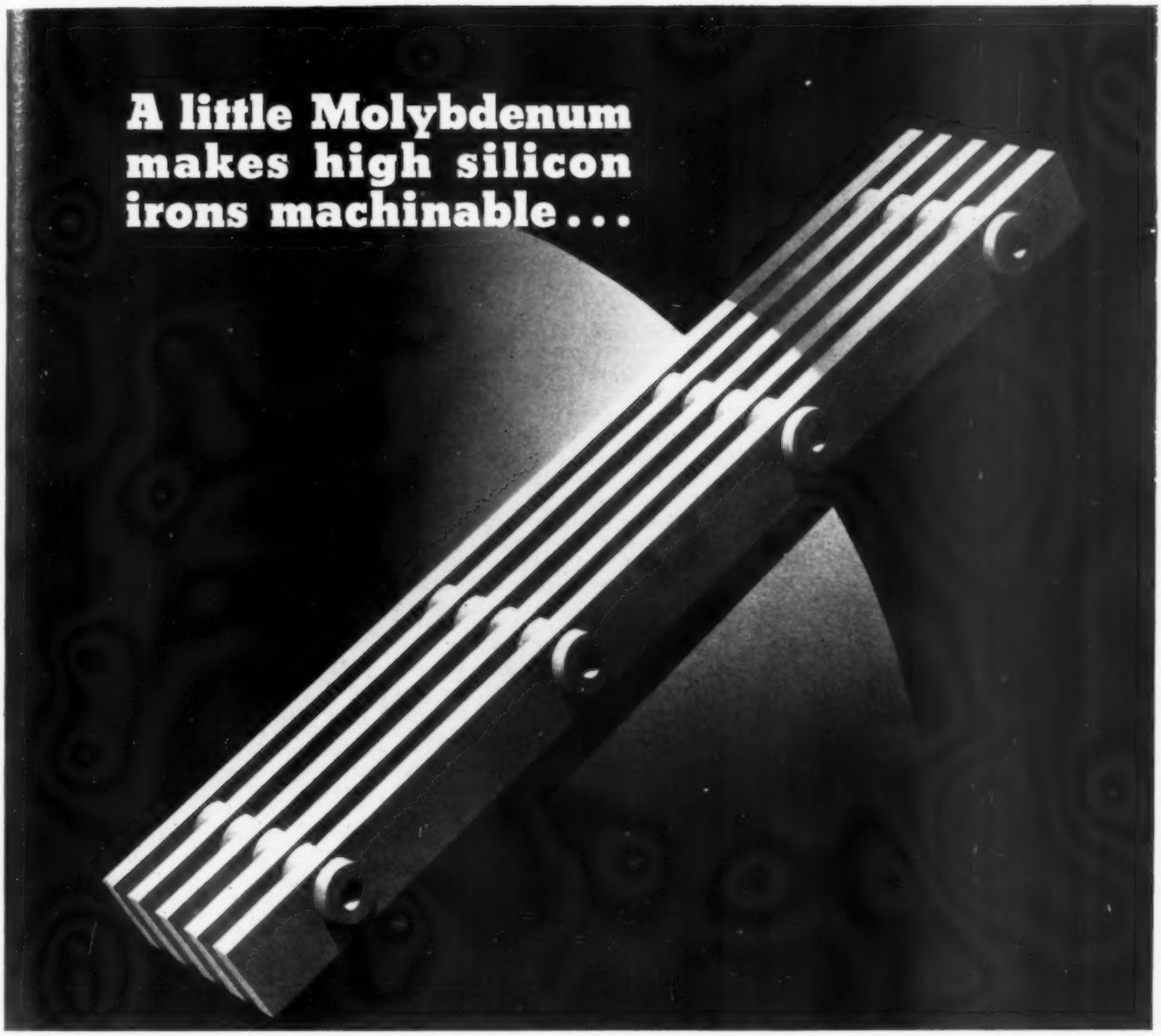
James MacBeth Jr.

B. E. Stewart

V. A. Crosby

Paul Fielden

A little Molybdenum makes high silicon irons machinable...



A high silicon cast iron with good elevated temperature strength and corrosion resistance, is very likely to be very difficult to machine.

The addition of about 1.0% Molybdenum to a high silicon iron licks the problem. The Molybdenum addition improves the elevated temperature strength. And the iron is made so readily machinable that smoothly finished surfaces and strong threads can be produced without difficulty.

This iron has proved suitable for such applications as grate bars, hearth plates, and still tube supports.

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ADVERTISING PAGES OMITTED

(*Concluded from page 78*)

board of directors are the following: Edward A. Bacon, Fred V. Gardner, Edmund Fitzgerald, W. D. Van Dyke Jr., John J. Chyle, August A. Jonas, John H. Casey, Walter J. Wilke, Julian C. Bolton, D. C. Letts and S. D. A. Cobb. Mr. Bacon recently has been appointed a lieutenant commander in the U. S. navy and is stationed at the Ninth Naval District headquarters, Great Lakes, Ill.

♦ ♦ ♦

DAVID THOMAS, owner of the Thomas Pattern Works, Detroit, studied patternmaking seven years in Wales, beginning his training at

David Thomas

the age of 13. Mr. Thomas came to this country when he was 21. During the first World war he was employed as a patternmaker in the navy yard at Charlotte, S. C., and in the ship yards in Philadelphia. Shortly after the war he went to Detroit, and after working in various pattern shops in that city, he established his own business there.

♦ ♦ ♦

FREDERIC V. MCARTHUR, secretary and assistant treasurer, Link-Belt Co., Chicago, retired June 30 after 49 years with the company. He has been succeeded as secretary by H. E. KELLOGG, treasurer. M. P. ANDERSON, general accountant, has been appointed assistant treasurer.

♦ ♦ ♦

MYRON POWERS recently has been appointed manager of purchases, Chicago Pneumatic Tool Co., with headquarters at the company's general offices in New York. Mr. Powers formerly was in charge of purchases at the Cleveland plant.

♦ ♦ ♦

PETRUS W. MEYERINGH recently has been elected vice president of Hercules Powder Co., Wilmington, Del., and member of the firm's executive committee. ALBERT E. FORSTER, general manager of Naval Stores department and LUKE H. SPERRY, chief engineer of the company, were elected directors of the company.

♦ ♦ ♦

L. W. GROTHAUS, vice president, Allis-Chalmers Co., Milwaukee, has been appointed head and G. V. WOODY, administrator of the recently established priorities management department. O. S. LARKBY JR. will serve as Mr. Woody's first assistant.

♦ ♦ ♦

LELAND H. GRENELL has been engaged by Battelle Memorial Institute, Columbus, O., for research and development work in new products. An important part of the immediate program in the field is development of improved alloys of copper for industrial application. Mr. Grenell is a graduate in metallurgical engineering, Pennsylvania State College. He was a member of the staff of the U. S. Bureau of Mines, and the National Bureau of Standards. For the past 5 years he has been engaged in process engineering and materials development for the Frigidaire division, General Motors Corp., Dayton, O.

Apprentice Course At Chesapeake

Efforts of the Chesapeake Chapter in establishing its first apprentice course during the 1940-41 season gave such excellent results that in the fall it will be the aim of the chapter to start another course, probably to continue throughout the winter. The course began on May 5 and ended on June 25. As shown in the accompanying illustration the apprentice class consisted of fifteen boys and two instructors. The instructors were G. O. Webster, Baltimore Polytechnic Institute and T. C. Worley, assistant superintendent of iron and nonferrous foundries, Bethlehem Steel Corp., Sparrows Point, Md.,

During the training course the following three lectures were given the students: C. W. Thompson, New Jersey Silica Sand Co., Millville, N. J., discussed, "Conditioning and Grading of Sands and Their Uses in the Foundry;" "Nonferrous Foundry and Molding Practice," was covered by E. W. Horlebein, Gibson & Kirk Co., Baltimore; and Bernard F. Drane, Kennedy Foundry Co., Baltimore, discussed, "Molding and Foundry Practice of Malleable and Gray Iron Castings."

The committee responsible for the organization of the course was as follows: Donald H. Lane, chairman, educational director, Bethlehem Steel Corp., Sparrows Point, Md., William C. Holtz, superintendent of foundry, American Brake Shoe & Foundry Co., Baltimore; William C. Franz, manager, Flynn & Emrich Co., Baltimore; Fred C. Roemer, superintendent of foundry, Balmar Corp., Woodberry, Baltimore; James J. Lacy, president, James J. Lacy Co., Baltimore; and Frederick G. Bruggman, sales engineer, Gibson & Kirk Co., Baltimore.

Students attending one of the apprentice training classes of the Chesapeake Chapter. First row, left to right: Ray Tiece, Bethlehem Steel Co.; Franklin Reigle, Standard Gas Equipment Co.; William Reigle, Standard Gas Equipment Co.; Lewis H. Gross, American Radiator & Standard Sanitary Corp.; Edward Lynch, Kennedy Foundry Co.; second row, Arnold Bauernfeind, Standard Gas Equipment Co.; John Hesmar, American Hammered Piston Ring Co.; William Wilhelm, American Hammered Piston Ring Co.; Jerry Paxton, Gibson & Kirk Co.; Charles Phillips, Gibson & Kirk Co.; Carl Trentler, American Brake Shoe Co.; third row, G. O. Webster, instructor; Peter P. Malinski, U. S. Coast Guard Yard, Curtis Bay; William A. Hook, Kennedy Foundry Co.; Orville Schwell, American Hammered Piston Ring Co.; James E. Dunivin, American Hammered Piston Ring Co.; T. C. Worley, instructor. Photo courtesy Fred Bruggman, Gibson & Kirk Co., Baltimore

COMMENT

DISTRIBUTION of orders for castings to be used in the production of war material and supplies has been exceedingly uneven. While many foundries in all four branches of the industry are operating at full capacity, 24 hours a day, and unfilled orders are greater than the ability of these plants to produce, other plants are searching for defense work. Before a company undertakes plant additions to care for this excess business, it might be well to consider seriously subcontracting the business on hand which is in excess of the shop's ability to produce. Putting idle capacity to work may prove much more profitable in the long run than constructing additional capacity which has the possibility of becoming a heavy liability in years to come.

—□—

CHROMIUM recently was added to the list of alloys on full priority control. This does not necessarily mean a shortage of the alloy, but rather an effort to conserve the supply for war purposes. Foundries making castings on orders carrying specific preference rating certificate should have no trouble in obtaining adequate supplies, although there can be no increase in inventories. Foundries making civilian work must wait until all war work has been cared for to see if some supply remains.

—□—

PRIORITIES division of the OPM recently opened six new field offices as an aid in supplying information to industry on the operation of the priorities systetm. The following are the cities and district managers: St. Louis, Louis E. Crandall; Denver, V. L. Board; Detroit, Walter Hall; Cleveland, W. Thomas Walker; Dallas, J. Burke Crocket; and Pittsburgh, Charles F. Cruciger. Offices may be reached through the Federal Reserve Banks in those cities, and the facilities should be utilized whenever needed by the foundrymen in these various districts. It is interesting to note that Mr. Walker at Cleveland has been engaged in sales and production work in aluminum foundries for a number of years.

—□—

TRAINING programs in various sections of the country are helping greatly to meet the demand for skilled men in the foundry industry. The organizations and individuals participating in this work are performing an exceptional service to the nation's war effort. But the demand continues to exceed the available supply as is indicated in a recent report which shows that in the 2-month period ending June 1, public employment offices received 2 or 3 times as many requests for skilled foundry workers as they had such skilled men registered. Further training programs, preferably on the job, are needed.

—□—

SIZABLE quantities of much needed alloys are being lost through alloy steel borings and turnings. Such scrap properly segregated and briquetted, provide an excellent source of alloys for many applications. Plans now are under way in the OPM to secure the co-operation of both producers and dealers of such scrap in the recovery of these alloys. Shortages of ordinary iron and steel scrap have directed considerable attention toward the possibilities of briquetting, and numerous installations of briquetting presses are being made.

—□—

IN DISCUSSING the present pressure for expansion of industrial facilities, E. L. Shaner recently made the following comment in *Daily Metal Trade*:

> In short, the industrial facilities of the nation are not yet being utilized effectively, and worse yet, instead of devoting adequate attention to getting the utmost output from existing equipment, we are talking wildly about new plants and new equipment—the planning and construction of which will further divert attention, materials and manhours of labor from the No. 1 objective of *immediate* output.

—□—

OBTAINING adequate supplies of raw materials has become the most important problem of the foundry industry. Even those foundries engaged in war work carrying high priority classifications are finding it most difficult to obtain ferrous and nonferrous scrap, pig iron, copper, brass, aluminum, magnesium, nickel, chromium, silicon and various types of fuels. Unless the individuals and groups making rules governing the distribution of such materials develop a better understanding of the need for castings in building the modern war machine, the situation is likely to get much worse before there is a turn for the better. A good example is found in the case of ferrous scrap, where a greatly increased demand coupled with price control and diminishing supplies provide a serious threat to the successful functioning of the foundry industry in a war economy. I believe prompt attention should be given by OPACS to the recent report of a committee organized by OPM with membership evenly divided among the various governmental agencies, the iron and steel industry and the scrap dealers. This plan was developed after considerable study and seems to have merit.

—□—

WHILE castings have been included in specially listed products on several blanket priority ratings, the new order for the production of machine tools is the first to include materials essential to the production of castings. This new order lists the following foundry supplies as coming within its extension provisions: Steel rail and other steel scrap, silvery pig iron, regular pig iron, coke, ferrosilicon, ferromanganese, vanadium, nickel, molybdenum, and chromium. Foundries producing castings for machine tool manufacturers should be interested in the fact that the provisions of the priority order may be extended to subcontractors.

—□—

A RATHER large foundry, which has floor and melting capacity far in excess of present business, is considering installing a converter and making other necessary changes to produce steel castings for government work.

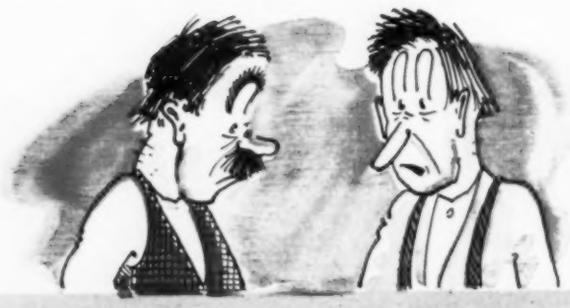
—□—

SPEAKING of converters, I wonder if the stringency of steel scrap may result in the use of the cupola, converter and mixing ladle to produce high test iron.

—□—

THE statement of the Crucible Manufacturers Association on page 26 of the July issue of THE FOUNDRY to the effect that 881 new crucible furnaces were installed in 1940-41 seems quite impressive. While a part of this represents replacement, a good portion provides an increase in the melting capacity of nonferrous foundries.

F. G. S.



THE ADVENTURES OF BILL

BY PAT DWYER *Drawings By* RICHEY

COMING out of New York," Bill said, "one night a couple of months ago, to be exact, the night the recent A.F.A. convention folded up, or about the middle of May, the train started as slowly and smoothly as one of the upper or better class snails out for the usual early morning survey of the menu so bountifully provided for all lowly creatures by the omnipotent and benevolent Creator. I did not invent that," he hastened to explain. "I mean the baloney about the snail and all that kind of stuff. I heard a bird use it one time at a lecture I was silly enough to attend under the mistaken impression that I was going to hear something really worth while. The title of the lecture was 'Low Life Exposed, or Doings in Dark Places.' All about snails, if you please, and other forms of squashy and loathsome creatures that live under stones, in holes in walls and trees. Horrible little things that lose their grip every now and again and fall down inside your coat collar. Your heart stops like a dollar watch when the main spring breaks—"

"Would you mind," I said, "kindly stepping aboard the train again and get going. At the rate you are traveling I would be willing to place a small wager that even an ancient broken down snail afflicted with the botts, a game leg and a dose of halitosis would beat you in a dead heat to the terminal. That is—which I am beginning to doubt—if there is a terminal. Give 'er the throttle and maybe a touch of sand before a coating of rust and snail juice sticks the wheels to the rails."

"Count ten, my boy. Count ten. No need of bursting your gall or tearing your shirt in two halves. I merely want to express my admiration for the locomotive driver who could set a great heavy train in motion, three or four baggage cars, a couple of coaches and a dozen Pullmans, set it in motion so gently that I was astonished to look through the window and note presumably stationary objects floating past. I do not know the driver. I never saw him and probably never shall see him, but he is an artist, a perfect performer. Nothing so nauseates me as applause for little men who never were there. On the other hand nothing gives me greater pleasure than to hand a bouquet to any person, man, woman or child who can and does deliver the goods."

"Consider yourself presented with a basket of Golden Rod, known to the botanist boys as Solidago, but much better known down around the old homestead as Stinkin' Willie. Where do we go from here?"

"What I was leading up to is the manner in which an incident starts

Waiting for the wind to go on

a train of thought that may carry a person through time and space with all the vividness of one of those dreams that prompts your sleeping partner to nudge you with a sharp elbow, beg you to close your mouth, stop yelling and go to sleep properly.

"This here train I am telling you about picked up speed in the tunnel, fled like a scalded cat across the Jersey marshes and then slowed down again coming into Newark. Before we crossed the river separating Harrison from Newark my eye lit on a huge illuminated sign Worthington Pump & Machinery Corp., and immediately I thought of my old friend Frank McGrail, first general foundry foreman after the company abandoned the former plant in Elizabethport and moved into the highly modern plant in Harrison, N. J.

"Frank probably was the most widely traveled member of an industry whose journeymen are afflicted with itchy feet. Following an apprenticeship at the famous Builder's Iron Foundry in Providence he shipped on a Gloucester fishing schooner for a season and spent another year with the oyster fleet in Chesapeake Bay. Then he went deep water sailing and in the course of about seven years he visited practically all the great ports all over the world. I had the melancholy pleasure of accompanying him about two years ago on his last short journey when he was laid away in the cemetery at Titusville, Pa. God rest him. He was a widely read and highly cultured gentleman, a typical example of a fast vanishing group, a master foundryman.

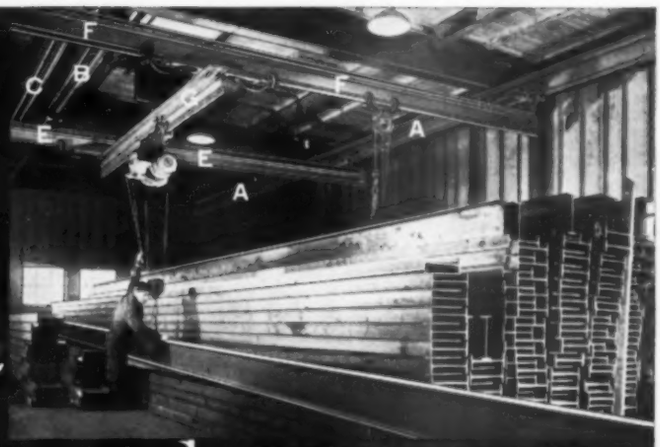
"In his sea faring days he took time out occasionally to visit and in some instances to work in foreign foundries, including one in China. By a curious coincidence about a week before the convention I had a letter from a Chinese foundryman who was making diesel engine castings. He complained that the sand stuck to the castings to such an extent that to quote his exact words, 'We cannot knock it off even with pneumatic hammers.'"

"You should refer that letter," I said, "to Bob Robinson, manager of core oil sales Werner G. Smith Co., lecturer on core room practice, the love life of a chicken and other related subjects before foundry groups from the Atlantic to the Pacific, master of ceremonies at every function at which he is present, all around good fellow and raconteur extraordinary in every known dialect including the Scandinavian.

"After he left school, LeRoy P., for that indeed is our hero's name,

(*Continued on page* 86)

New AMERICAN MONORAIL Criss-Cross System AIDS PRODUCTION



Criss-cross or 3-level American MonoRail System stores steel taken direct from gondolas. (Letters on equipment correspond with those on layout below.)

Overhead MonoRail serves the punch (and all units) efficiently . . . fully covers the area . . . permits passing of loads . . . moves them easily.

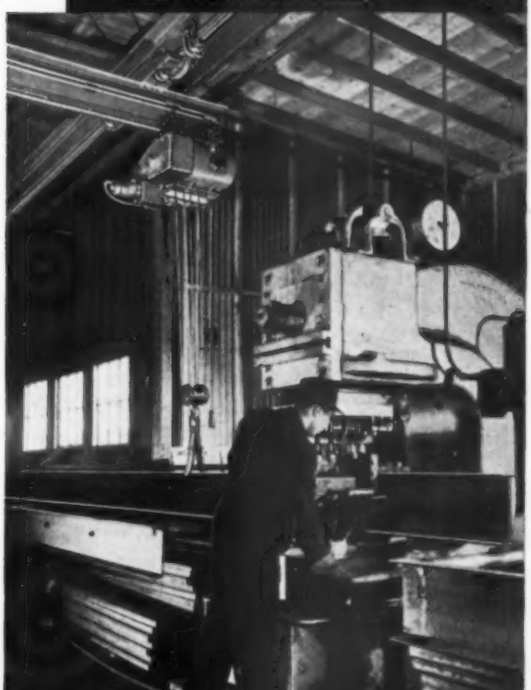
THIS newly developed MonoRail System of rails, cross rails and bridges is a most efficient and economical means of overhead handling in small plants.

With this system you can place the load exactly where you want it—in storage, fabrication or shipment.

By eliminating floor congestion American MonoRail increases plant capacity. By providing superior mechanized methods for lifting and carrying, it increases the productivity of labor. Skilled labor is not required in its use. Operation and maintenance, a minimum. In many plants this low cost, flexible handling system has soon repaid its cost.

Just what saving you can realize can be soon determined by an American MonoRail engineer. Write us about your problem.

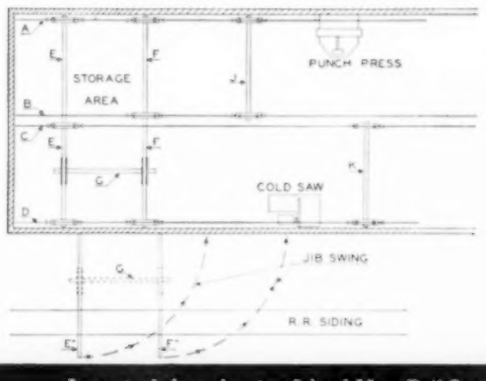
Ask for free copy of "Blue Book" illustrating numerous installations.



In unloading or loading parallel jibs (E' and F' on layout) are swung out from building interlocking with tracks (inside) carrying MonoRail bridge equipped with electric hoist . . . unloads and stores without rehandling.

THE AMERICAN MONORAIL CO.

13104 Athens Avenue Cleveland, Ohio



Layout of shop showing 3-level MonoRail System.

ADVERTISING PAGES REMOVED

(*Continued from page* 84)

tendered his services to various employers for varying periods of time. He was a brakeman, clarionet player, vaudeville performer, salesman of all kind of gadgets, pianos, furniture, kitchen utensils, brushes, mops, pails and mouse traps—"

"Are you talking about Bob Robinson?"

"The one and only. Only a select few know that his name is LeRoy and no living person ever learned what the *P* stands for. Vociferous foundrymen on -er- ah-vociferous occasions have suggested that the *P* stood for penny ante, pinochle or poker. Up to the present no person has suggested that the initial possibly might stand for Prim or Pious.

"Many years ago in the old historic city of Boston he stumbled into a job which proved a turning point in his career and the first step leading to a position in which he has been a shining light for 20 years or more. Replying to a want ad he found a core oil maker who wanted a salesman. The first part of the interview was highly satisfactory on both sides, but when the prospective employer discovered that the applicant never even had heard of core oil his ardor cooled. In his opinion, expressed freely and fluently, the young cub certainly had a nerve applying for a job which could be handled only by a highly competent specialist, familiar with core room practice and problems. Bob calmly swept the argument into the discard. In his candid opinion a man with his experience and knowledge could sell anything. 'Tell you what I'll do', he announced handsomely. 'Give me a trial for a week. If your stuff is any good I can sell it. If it is not any good I can't sell it and the trial won't cost you a penny.'

"The old boy took him in and filled him full of information. He itemized all the selling points and instructed him how to handle every possible and impossible question that might be fired at him. When he considered the young man was fairly saturated and dripping, he gave him a list of prospects, character of the work they handled and in many instances supplied valuable information on personal characteristics, habits, customs and as he explained, the devilish ingenuity some of these hardened old foundrymen displayed in refusing to place an order.

"The first prospective customer received him with traditional New England kindness and courtesy. Fine men up in that part of the country, but when it comes to turning an honest penny they are just as shrewd and keen as their sea faring fathers and grandfathers who built the tall ships and sailed them to the round world's rim and exchanged glass beads, cotton cloth, cast iron hatchets and other attractive gadgets, hickeys and doodads for cargoes of other materials of little or no value to the original owners, but highly coveted by the so called civilized North Americans who eagerly snapped them up at prices highly gratifying to the bold adventurers.

"Bob put on the sales talk with vim and vigor, ornamented with oratorical flourishes, touches of wit and wisdom and of course illustrated with suitable gestures. He dwelt upon the superior chemical and physical properties, relatively small amount required, ease of mixing, non-migration, iodine value, oxidation, saponification, eternal salvation and the chances of the Boston Braves in the pennant race. He pledged his sacred word of honor as a fellow foundryman that this particular oil would dry faster than any other, make better cores and cause the coremakers to give three rousing cheers for the boss every time his head appeared above the horizon. For a final clincher he claimed that one good rap of a hammer would cause all the core sand to run out of the casting as readily as it flows through the kitchen sand glass which regulates the condition of the morning egg.

"The customer was impressed 'One thing you have not touched upon,' he said. "Will that stuff of your's make the sand stick to the coreboxes?'

"This was the one and only feature that had not been included in Bob's course of instruction. He had to think quick. 'Stick?' says he as bold as you please 'That stuff stick? Say brother, you can't knock it off with a hammer and chisel!'

"When I read this letter from the Chinese foundryman, I was telling you about, some time back, I was reminded of this historical incident and wondered if Bob or one of his men had gone for a gander down the old Burma road recently. Listen:

"We have great trouble cleaning diesel engine castings. Cores are made from a mixture of 50 per cent silica sand and 50 per cent red sand, silica content 80 per cent, and 3 per cent bentonite. Castings are poured at a temperature of 1350 degrees Cent. (2462 degrees Fahr.) Sand sticks to the casting so hard that we cannot knock it off even with pneumatic hammers. We remove all we can and then pickle the castings in 10 to 15 per cent sulphuric acid for 12 to 18 hours and then soak them for additional 3 to 4 hours in lime water. Finally they are washed in clean water. Despite this procedure sand pockets in intricate parts keep a man busy for one or two days cleaning out the sand.

"Without further particulars," Bill

(*Concluded on page* 90)

Nothing like it seen in these here parts since medicine men sold the famous old Kickapoo Indian Sagwa

By A. H. ALLEN
Detroit Editor, The Foundry

AMONG DETROIT FOUNDRIES

BROUGHT to a successful conclusion last month, the 1941 automobile model season was one of the best the industry has ever experienced. Now, with the defense load becoming heavier daily, the auto plants are keeping their fingers crossed about the 1942 model season. The cars are all ready to go, but the big question mark is materails—which ones will be available and in what quantity? In the answer to this question lies the production story for 1942 models.

Car builders are not inclined to worry so much about a market for cars this fall. They reason, and with a good deal of logic, that wages everywhere are mounting, jobs are multiplying and the necessity for transportation is considerably greater than many government officials would have the public believe. Large numbers of defense plants are being erected in outlying locations, approachable by masses of workmen only if they have cars to drive. And with money in their pockets, these workmen will be in the car-buying mood.

Men Are Available

There is not any great amount of concern shown either about the effect of labor shortages resulting from the transfer of men from auto plants to defense plants. In fact, one recent survey submitted to the governor of Michigan indicated that the proposed 50 per cent curtailment in auto production would result in 60,000 men being thrown out of work in Michigan alone, even giving consideration to 30,000 more being absorbed in defense manufacturing.

This is certainly one thing which Washington never would countenance—unemployment in the face of an abundance the like of which the country has never seen. Far more logical is the Knudsen approach: That cars will continue to be made in such volume as available materials and parts permit, and that auto plant workmen will be transferred to defense jobs as the latter open up so they will lose no working time in making the change.

About all engineers could do in the face of unknown future developments on the materials score, was to devise and perfect as many possible alternates for every part which appeared at all likely to be affected by shortages or other critical conditions. Thus in some parts there are four or five alternates worked out which can be turned to in a moment's notice if an emergency should arise.

Strong emphasis is being placed on the fact that changes in materials specifications should in no sense be considered as "ersatz" or substitutions for time-tested quality.

R. H. McCarroll, Ford metallurgist, says, "Materials can be changed if we make corresponding or compensating changes in design." He referred particularly to a change in valve design which permitted the elimination of nickel used in alloy valves. Some changes will bring slightly increased weight, according to McCarroll, who estimates that this greater heft will amount to less than 5 pounds in Ford and Mercury, and not more than 20 pounds in the Lincoln lines for 1942.

"Many people ask," McCarroll continues, "how it is that, if cast iron in many instances can be substituted without loss of quality for aluminum and zinc, it has not been done before. Certainly the main thing that will result, if we make many of these substitutions, is an increase in cost. For instance, the cost of the material in an iron carburetor would be less than the cost of the material in the zinc die cast carburetor, but the machining saved with zinc more than makes up for

Candid shots snapped by the ubiquitous editor of this department at the June 19 golf party and business meeting of the Detroit Chapter. Upper left (Left to right)—W. W. Bowring, Frederic B. Stevens Inc., and treasurer of the Detroit Chapter, and H. Grostick of the same firm. Upper right (Left to right)—M. L. Carpenter, Cadillac Motor Car division, A. J. Gonter, Dodge division, and C. H. Hungerman, Cadillac Motor Car division. Lower left—Two old timers get together. James L. Mahon, American Car & Foundry Co., left, and Jess Stoddard, Detroit Testing Laboratory. Lower right (Left to right)—Vaughan Reid, City Pattern Works; C. A. Cahn, Automotive Tool and Die Manufacturers' Association; Edward J. Jeffries, Mayor of Detroit, and R. P. Fohey, Chrysler Corp.

the difference in material cost.

"The thing I want to stress is that we very definitely will not build an 'ersatz' car made up of inferior materials. The cars will cost us slightly more to build and will be slightly heavier, but the owner would never know the difference as far as the performance and operation of his car are concerned."

As the Ford metallurgist suggests, the change to cast iron in carburetors has its unfortunate angle in the high machining cost of the iron. As far as foundry practice is concerned, much better carburetor castings can be made today than ever before, but the inability to core out an iron casting, and keep the cores in place, to the same extent possible in a zinc die casting, makes machining protracted and tooling costs high.

Reflecting sadly on this forthcoming change, the chief engineer of one of the other motor companies said ironically, "Yes, we will have to go to iron for our carburetors and with our carburetor setup they will be so heavy that we will have to swing them from an I-beam running the length of the engine compartment."

Use Cast Iron Pistons

This sounds like a slap at cast iron but actually it is not. Motor car engineers just like to have the right material in the right place and cast iron simply cannot compete with zinc die castings for carburetors.

There might be more room for argument on the subject of pistons, inasmuch as three makes of cars have been using ferrous pistons right along. Next year's models will see many more converts to iron pistons, some temporary until aluminum is available again, some perhaps permanent.

Buick's iron piston lines is going in good shape and Bill Mixer, foundry superintendent has done a rather remarkable job of lining up facilities and equipment to turn out 16,000 pistons in an 8-hour trick. Foundrymen from near and far have been visiting Flint to see the installation and are uniform in their admiration. As mentioned here briefly last month, the pistons are cast ten in a mold, with dry sand cores, the molds traveling right along the same line with other small castings, such as manifolds, exhaust lines, etc. Two molding machines and two coreblowing machines are sufficient to meet the production. Cores are held to exceptionally close tolerances and special fixtures are used to set them in the mold.

First pistons cast were conventional flat-top type, but later this was changed and now the regular Buick dome-top pistons are being made, weighing around 25 ounces. Shot blasted after being shaken out, the rough castings are good examples of modern foundry practice and even on the inside around the bosses are clean and smooth. After machining and cam grinding they are given a Parkerizing treatment to coat the surface and minimize initial scuffing.

Increasing pistons weights by 75 per cent in the Buick 8-cylinder engine put an additional load on connecting rod bearings, and engineers were doubtful whether it would be safe to release such an engine for production. Meanwhile they were playing around with bearings and crankshafts in the effort to find some way to step up bearing life. One thing led to another and finally it was discovered that, up to a certain point, the rougher the steel crankpins were the longer became connecting rod bearing life. Such a finding was contrary to all accepted theories, but nevertheless subsequent tests confirmed the observation, so engines next year will have crankshafts with pin and main bearing journals of average surface roughness 50-70 microinches—the term used to express average depth of grinding scratches in millionths of an inch compared with 4-5 microinches specified on 1941 model shafts.

Lapping time is reduced to 5-10 seconds from the former 48 seconds, with conventional machining and grinding treatments continued. Both dynamometer and road tests proved conclusively that the rougher journals resulted in greatly improved life of the thin-babbitt connecting rod bearings.

Another show spot of the Buick foundry is the brake drum line where six specially built centrifugal casting machines are set up to turn out 180 drums an hour each. The machines are similar to those used by McLaughlin-Buick at St. Catherines in Canada, but have been modified and improved considerably. Each has ten spinner heads housing split Meehanite dies into which a steel backing plate is chucked and molten iron is poured while the die revolves at 410 revolutions per minute. After cooling the dies separate and the drum drops out, being virtually a permanent mold casting, mechanically locked to projecting fingers on the hub plate. No coating is used on the die, since none could be found which would withstand the 2650-degree temperature of the iron.

Chief problem lately has been die life. An improvement followed slowing of the rotational speed from 600 revolutions per minute to the present 410, but still greater extension of die performance is being sought. By changing the section of the die to permit better conduction of heat away from critical areas, it is felt that die life eventually can be pushed to 450-550 drums per die.

Adventures of Bill

(*Concluded from page* 86)

concluded, "and basing an opinion merely on the evidence submitted I wrote this seeker after the light that the core sand he is using apparently contains an excessive amount of low fusible clay which reduces the total refractoriness. When this mixture is exposed to and surrounded by the heat of the molten iron, it melts or fuses to form a species of glass or enamel which adheres to the metal. In American foundry practice cylinder cores, especially the port cores and others of small size or intricate shape are made entirely from silica sand bonded with oil. The outside surface is covered with a coating of wet blacking, dried of course before the cores are placed in the mold. The blacking may be a prepared mixture based on ground pitch, or plumbago. It is mixed to a creamy consistency with water containing a small amount of molasses or other water soluble binding agent. In addition to serving as a binding agent while the core is green, the greater part of the oil evaporates or is oxidized during the baking process. The remainder is burned out when the core is surrounded by molten metal. The combination of refractory sand, blacked surface and reduction in the amount of oil remaining in the core, forms a combination through which the core disintegrates and readily is removed from the casting. Where the castings are tumbled the burned sand flows through the various openings. In the subsequent blasting process, the remainder of the sand is blown out. The need does not exist, therefore castings of this kind are not pickled in American foundries. In a method developed a few years ago and now used quite extensively, castings are cleaned by a small stream of water and sand directed through a hose at a pressure of 1000 to 1200 pounds per square inch. According to American standards the casting temperature of 1350 degrees Cent. is too low. Apparently in this case it is held low to favor the cores. However, cold metal introduces many hazards and is not favored in American foundries where the metal is tapped at a temperature of approximately 2800 degrees Fahr. (1538 degrees Cent.) and poured at a temperature between 2600 and 2700 degrees Fahr. (1427 and 1482 degrees Cent.)."

Public Affairs Committee Inc., 30 Rockefeller plaza, New York, recently has published No. 57 of its series of pamphlets on public affairs. The pamphlet is entitled, "Man Meets Job—How Uncle Sam Helps," by Philip S. Broughton. Copies may be obtained for 10 cents each.

Inexpensive Insurance Against Health Hazards

SLY DUST CONTROL AIDS PRODUCTION

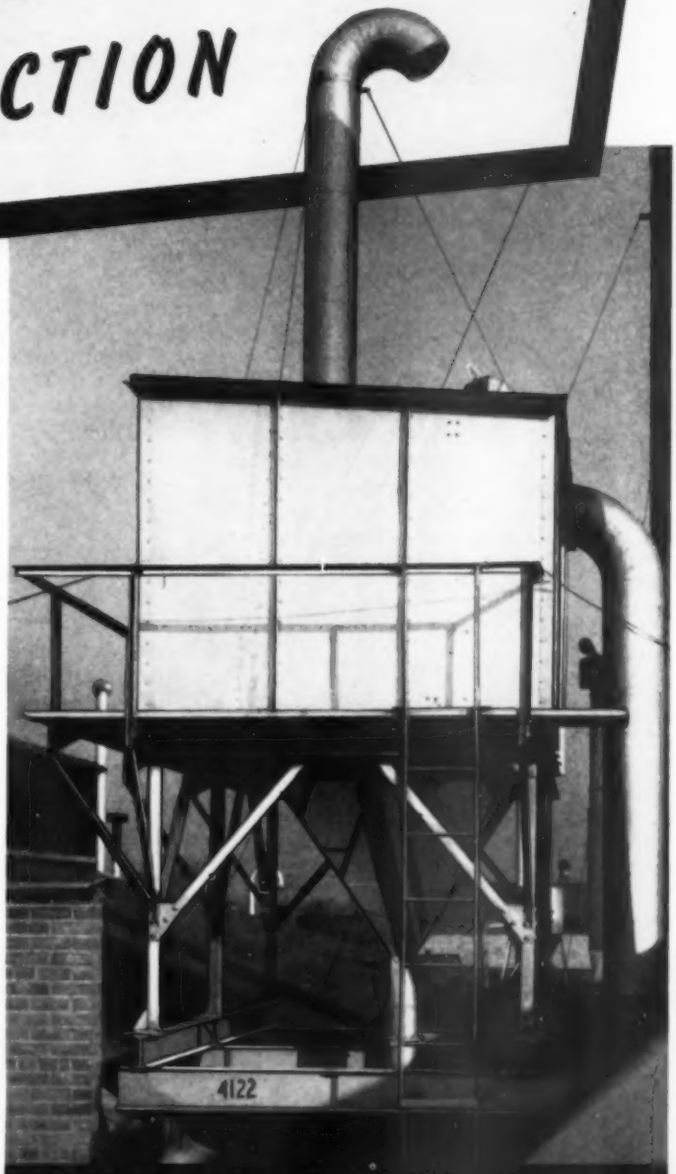
TODAY with the urge to increase production, to guard the safety and health of employees, the value of adequate dust control becomes increasingly important.

These very conditions demand utmost care in the selection of the system to best serve your needs.

Sly Dust Filters offer these outstanding advantages: (1) They clean the air thoroughly by completely filtering *all* visible dust from it. (2) By reason of more filtering cloth they yield greater filtering capacity. (3) Because of taut bags (patented) they save power and effect more positive removal of dust. (4) With a simpler shaking mechanism and automatic control they save on operation and maintenance costs. (5) Characterized by simplicity of design they are easily installed and easy to maintain.

The net result—improved quality of product, better working conditions and greater production which soon repay cost.

Send us complete information about your problem so that we can write you fully. Ask for Bulletin 98.



Sly Dust Control installation for The Commercial Steel Treating Co., Detroit, Michigan. Used for ventilating five Sly Blast Cabinets, one Sly Tumbling Mill and three Sly No. 4 Blast Mills.

THE W. W. SLY MANUFACTURING COMPANY

Branch Offices in Principal Cities

SLY
INDUSTRIAL DUST CONTROL

4753 Train Avenue
Cleveland, Ohio

BLAST CLEANING EQUIPMENT · TUMBLING MILLS

Activities of FOUNDRY GROUPS

St. Louis

APPROXIMATELY 200 foundry men and friends attended the June 14 barbecue, picnic, and outing held by the St. Louis District Chapter at Joe Davies' Country Club, Ferguson, Mo. The good attendance was taken as an indication of increased interest in the chapter and chapter activities, and was an opportunity for all to enjoy themselves thoroughly and—they did!

Good old barbecued ribs, potato salad and all the trimmings were the order of the day, all being accompanied by a wash-down of St. Louis nectar. There were ball games, horseshoe pitching, as well as various and sundry other sports. Everyone participated and all reported a swell time.—*J. W. Kelin, secretary-treasurer.*

Detroit

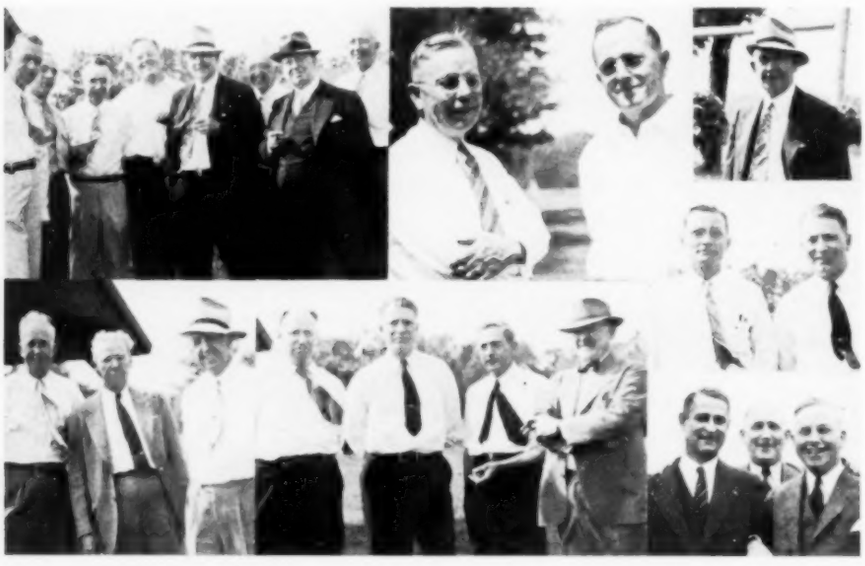
THE Detroit Chapter blew the lid off of its summer golf season June 19, at the Tam-O'Shanter Golf and Country Club and ideal weather attracted better than 30 to the links for a gala afternoon of pill-pounding. By the time the dinner bell rang at 7:30 p. m. another score or more of foundrymen had put in appearance for an all-out Frankenmuth style chicken dinner.

Guests of honor included Mayor Edward J. Jeffries of Detroit, C. A. Cahn, secretary of the Automotive Tool and Die Manufacturers Association, and R. P. Fohey, secretary of the Chrysler Corp. With their host Vaughan Reid, president, City Pattern Works, they made a foursome which walked off with near-top honors in the golfing.

Following the dinner, Chairman Glenn Coley, Detroit Edison Co. introduced the guests, and the mayor offered a few brief remarks (non-political). Being the annual business meeting of the chapter, the formalities of reports from the treasurer and the secretary were observed, and the chairman announced the slate of new chapter officers for the coming year. Absence prevented V. A. Crosby, Climax Molybdenum Co., from accepting the gavel as the incoming chairman.

W. B. Crawford, Atlas Foundry Co., and George Fuller, Federal Foundry Supply Co., constituted a committee of two which awarded several dozen golf balls to the golf champs and others.

In the interests of promoting the national defense program, (as well as realizing 2.9 per cent interest on the money), the Detroit Chapter is making arrangements to purchase several defense savings bonds out of funds available in the chapter treasury.—*A. H. Allen, secretary.*



Approximately 250 foundrymen attended the annual picnic of the Western New York Chapter which was held on June 7. Photos courtesy Robert K. Glass, Republic Steel Corp., Buffalo

Western N. Y.

APPROXIMATELY 250 foundrymen attended the annual picnic of Western New York Chapter on June 7. Everybody had a splendid time enjoying the meals, games, prizes and all the other things.

Included with the day's activities was the election of officers to serve for the coming year. These are: Chairman, Robert K. Glass, Republic Steel Corp., Buffalo; vice chairman, Ralph T. Rycroft, Jewell Alloy & Malleable Co., Buffalo; treasurer, V. L. Whitehead Jr., Whitehead Bros. Co., Buffalo; secretary, Eliot Armstrong, Inter-Allied Foundries of New York State, Buffalo. Directors elected to serve three years, F. J. Comerford, Symington-Gould Corp., Rochester, N. Y., J. Ralph Turner, Queen City Sand & Supply Co., Buffalo, James L. Yates, Worthington Pump & Machinery Corp., Buffalo; to serve two years, R. D. Loesch, Lake Erie Foundry Co. Inc., Buffalo, Joseph Kaufman, Harrison division, General Motors Corp., Lockport, N. Y.; to serve one year, Joseph J. Mayer, Lumen Bearing Co., Buffalo, John C. McCallum, McCallum-Hatch Bronze Co., Buffalo, and Alex Rankin, Lake Erie Engineering Corp., Buffalo.—*Eliot Armstrong, secretary.*

N. California

ANNUAL meeting of the Northern California Chapter was ladies night and was held at the Lake Merritt hotel, Oakland, Calif., June 20. One hundred and eleven men and women enjoyed fellowship, a good dinner, floor show and

(*Continued on page* 94)

Now a new
16"
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JOLT SQUEEZE
STRIPPER
Present day demand on foundries for increased quantities of larger sized moulds is met by this Osborn machine. It's the new 716PJ—a big, husky machine, with 16" squeeze cylinder, offering the operating advantages of high production equipment plus the ability to accommodate a wide range of flask sizes and shapes for semi-production or jobbing work.
This modern jolt squeeze stripper has many design and construction features that insure efficient and continuous production of high quality moulds. Among these are—lifting pins adjustable for wide range of flask shapes and sizes; oil draw control, with slow draw, acceleration and cushioned stroke automatically controlled; operating valves located for maximum convenience of operation; squeeze head platen quickly and easily adjustable for desired flask space; hard, effective jolt, with jolt and squeeze cylinders separate for economy of maintenance.
An experienced Osborn representative will be glad to discuss with you how this new 16" Jolt Squeeze Stripper can be applied to your production requirements. Write for complete data today.
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Specifications for Machine Number 716PJ
Table Size . . . . . 22" x 34"
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Jolt Cylinder Diameter . . . . . 7"
Pattern Draw Maximum . . . . . 7"
Lifting Pin Centers Adjustable Left to Right . 21" to 35"
Lifting Pin Centers Adjustable Front to Rear . 20" to 24"
OSBORN
Moulding Machines

(*Continued from page* 92)
dancing. The short business session necessary to elect new officers and directors did not detract from the evening's pleasure.

Everyone had a happy time and became better acquainted. On retiring, Ivan Johnson lost no time in going through his program. He recognized the support given him and introduced the newly elected officers and directors, who are as follows: Chairman, Edward M. Welch, American Manganese Steel division, American Brake Shoe & Foundry Co., Oakland; vice chairman, Fred A. Mainzer, Pacific Brass Foundry of San Francisco; secretary-treasurer, George L. Kennard. Directors for 2 years, Howard I. Detro, American Radiator & Standard Sanitary Corp., Richmond, Calif.; Ivan L. Johnson, Pacific Steel Castings Co., Berkeley, S. D. Russell, Phoenix Iron Works, Oakland; and Richard Vosbrink, Berkeley Pattern Works, Berkeley. Encouraged by the success of their predecessors and their own determination to give their best efforts, the new officers and directors promise another forward moving year for the chapter and for the association.

The secretary's bride of two months was called to the head table by S. D. Russell and presented her with a magnificent floor lamp as a wedding gift from "A Bunch of Sand Rats". The response of gratitude was genuine. To Mr. Russell fell the honor of serving Mrs. Ivan Johnson with a beautiful silver service tray in affectionate remembrance to each of them for Ivan's year of service. In fact service and appreciation of service was the evening's theme song.—*George L. Kennard, secretary-treasurer.*

Central New York

REGULAR meeting of the Central New York Chapter was held at the Onondaga Hotel, Syracuse, N. Y., June 13. Approximately 75 members turned out for the meeting. Chairman Frank Wheeler, presided at the business session immediately following the dinner and called upon the chairman of the nominating committee for his report. The following members were nominated and unanimously elected for the fiscal year 1941-42: Chairman, L. D. Wright, superintendent, United States Radiator Corp., Geneva, N. Y.; vice chairman, N. J. Boardman, metallurgist, Elmira Foundry Co., Elmira, N. Y.; secretary, L. E. Hall, superintendent, Syracuse Chilled Plow Co., Syracuse, N. Y.; treasurer, E. G. White, plant manager, Crouse-Hinds Co., Syracuse, N. Y.; program chairman, nonferrous group, G. M. Thrasher, R. Lavin & Sons, Elmira, N. Y. Directors for three years: Frank Wheeler, Kimman & Wheeler, Syracuse, N. Y.; E. J. Bair Sr., Utica Radiator Corp., Utica, N. Y.; M. G. Hollenbeck, Kennedy Valve Mfg. Co. Inc., Elmira, N. Y.

Following the annual election of officers, V. L. Whitehead, Whitehead Bros. Co., showed a motion picture entitled, "Sand" which that company recently developed depicting the growth and development of the sand industry. The picture was well received and enjoyed by the members.

Eliot Armstrong, general executive secretary, Inter-Allied Foundries of New York State, Buffalo, then was introduced to the members, and addressed them on the subject, "The Effect on the Foundry Industry of Recent National Legislation." Mr. Armstrong very frankly explained to the foundrymen present the effect on their business of the recent social legislation passed in congress. The speaker warned the foundrymen that now is the time to put forth every effort to protect the foundry industry. Those present enjoyed Mr. Armstrong's address and held an interesting discussion period immediately following.

The next meeting of the Central New York Chapter will be held Sept. 12 at the Onondaga Hotel, Syracuse, N. Y.—*L. D. Wright, chairman.*

Wisconsin

WITH President B. D. Claffey presiding, the Wisconsin Chapter ended a highly successful 1940-41 season with an awards dinner at the Hotel Schroeder, Milwaukee on May 23. After reporting on the accomplishments of the chapter during his administration, Presi-

(*Continued on page* 97)

Annual stag picnic aud outing of the Northern Illinois-Southern Wisconsin Chapter was held at Svithiod Park, Rockford, Ill., on June 7, and will be remembered long by those present. Photos courtesy John Bing, A. P. Green Fire Brick Co., Milwaukee

(*Continued from page* 94)

dent Claffey called on E. O. Jones, national director of safety and hygiene section, and secretary of the national membership committee, who presented to the chapter the membership bell for winning the national chapter membership contest which closed in June.

Mr. Jones congratulated the chapter and thanked W. A. Hambley, Allis-Chalmers Mfg. Co., Milwaukee, chairman of the chapter's membership committee and President Claffey, co-chairman of the national committee for their loyal support. David Zuege, Sivyer Steel Casting Co., Milwaukee, chairman of the student aid committee, commented on the success of the loan funds established at the University of Wisconsin, Madison, Wis., and Marquette University, Milwaukee, and pointed out that the project was well worthwhile. He also reported on the results of an essay contest sponsored at the two universities. First prize winner at Marquette University was Frank Brendler whose essay was entitled, "Importance of Cost Determination in Modern Jobbing Foundries," and the second prize winner was Tom E. Armstrong, whose essay was entitled, "A Discussion on the Substitution of Copper for Nickel in Making Alloy Cast Irons." First prize winner at the University of Wisconsin was Charles S. DuMont, whose paper was entitled, "The How and Why of Foundry Practice." The second prize was a tie between Charles MacNeill, "Impressions of a Foundry Novice," and Charles W. Phillips on, "Melting Practice at the Vilter Mfg. Co. Foundry." First prize winners received $15 while the second prize winners received $10 in cash. In the tie, the prize money was divided equally between the two contestants.

W. E. Watson, Allis-Chalmers Mfg. Co., West Allis, Wis., presented a report on the results of the local apprentice contest and the national apprentice contest. Checks and certificates were presented to Tony Ivancich, Standard Brass Works, Kenneth Zinda, Allis-Chalmers Mfg. Co., first and third place winners respectively in nonferrous molding, and H. Novak, Maynard Electric Steel Casting Co., second place winner in the steel molding contest.

High spot of the evening was presentation of service plaques to a group of old timers. Following presentation of the plaques, President Claffey turned over the gavel to the newly elected chapter president, A. C. Ziebell, Universal Foundry Co., Oshkosh. Mr. Ziebell called on W. J. MacNeill, Federal Malleable Corp., to present to the retiring president the past president's A. F. A. ring.

Cincinnati

ANNUAL outing of the Cincinnati District Chapter was held June 10, at the Hyde Park Golf and Country Club. One hundred twenty-five members and guests present enjoyed golf during the afternoon, for which prizes were awarded at dinner. A baseball game scheduled for the afternoon was rained out. Following a sumptuous buffet dinner, an excellent floor show was presented. Directors to serve for 3 years were elected as follows: Wm. M. Ball Jr., Edna Brass Mfg. Co.; Charles Hilb, H. Kramer & Co.; E. H. King, Hill & Griffith Co.; Martin F. Milligan, Lunkenheimer Co. Members of the board who have yet to serve 2 more years include: L. A. Gosiger, S. Obermayer Co., Herschel W. Kautz, Cincinnati Milling Machine Co.; J. W. Nichols, Ingersoll Rand Co.; Henry M. Wood, W. W. Sly Mfg. Co. Directors to serve the final year of their term are: Herman K. Ewig, Cincinnati Milling Machine Co.; Frank E. Hutchinson, Reliance Foundry Co.; E. F. Loges, Kramer Bros. Foundry Co.; Henry F. McFarlin, Lunkenheimer Co.

Directors meeting was held June 17 at Shullers restaurant. Following the treasurer's report by L. A. Gosiger, formal appreciation of the

Some views taken indoors at the recent outing of the Pittsburgh Foundrymen's Association. Photos courtesy R. L. Hartford

board to the retiring chairman, H. F. McFarlin, was expressed unanimously. The board then elected the following officers to serve for the coming year: Chairman, William M. Ball Jr., Edna Brass Mfg. Co., vice chairman, Frank E. Hutchinson, Reliance Foundry Co.; secretary, Henry M. Wood, W. W. Sly Mfg. Co. and treasurer, L. A. Gosiger, S. Obermayer Co.—*Henry M. Wood, secretary.*

Chesapeake

ALL officers and directors of the Chesapeake Chapter were re-elected to serve for the coming year at the final meeting of the season which was held at the Engineers' Club, Baltimore, May 23. The meeting, "Equipment Night" featured short talks by the representatives of several foundry equipment and supply firms. Those who spoke included: L. D. Reed, Philadelphia district manager, Whiting Corp., who discussed, "Cupola Equipment;" "The Economy of Modern Blast Cleaning Equipment," was the title of the talk given by A. L. Gardner, advertising manager, Pangborn Corp., Hagerstown, Md.; C. W. Thompson, New Jersey Silica Sand Co., described the "Handling of Silica Sand from Banks to the Customer;" National Engineering Co., Chicago, was represented by L. B. Knight Jr., sales manager, who discussed, "Sand Preparation, Reclamation and Control;" A. R. Vanderbeck, sales representative of Modern Equipment Co., Port Washington, Wis., discussed, "Pouring Equipment." Approximately 100 members and guests were present.—*L. H. Denton, secretary.*

N.E. Ohio

APPROXIMATELY 400 members and guests Northeastern Ohio Chapter A. F. A., the largest number to date, attended the annual outing at Lake Forest Country Club, Hudson, O., June 28. Temperature was unusually high, but that did not prevent participation in the list of games and pastimes usually provided on occasions of this character ranging in physical effort from that involved in tossing the cubes and counting the spots, to propelling a ball by a violent series of strokes to every one of 18 little holes located from 400 to 500 yards apart on a terrain apparently designed for the use of stalwarts with extensive hill climbing and mountain experience. At an elaborate chicken

(*Continued on page* 100)

A large turnout of members and guests enjoyed the annual outing and golf tournament held by the Cincinnati Chapter on June 10 at the Hyde Park Golf and Country club

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(*Continued from page* 98)

dinner which concluded the day's program an extensive list of prizes was distributed to heroes who had distinguished themselves by individual deeds of skill, daring and dexterity. Door prizes also were awarded to other members who had not risked their lives on the burning sands of the desert, but had spent the day on a shady veranda indulging in games of chance and other low forms of amusement—certainly never learned at their mother's knee—favored by foundry men between heats.

Among the golfers the first prize for low gross score was won by Dave Halub. Second prize won by Bruce Aiken, Crucible Steel Co. First prize for low gross on the first nine was won by Bob Wellman, THE FOUNDRY, and second prize was awarded Mike Thomas, City Foundry. On the low gross for the second nine Marcel Reymann, Atlantic Foundry, Akron, won first prize and J. E. Jackson, won second prize. G. D. Hayes made the highest gross score. Blind bogey prize winners included W. D. Dodge, Union Metal Mfg. Co.; H. J. Trenkamp, Ohio Foundry Co.; H. Doster; C. E. Furry; H. C. LeBeau; George Stewart; George Nestor and Russ Wenk.—*Pat Dwyer.*

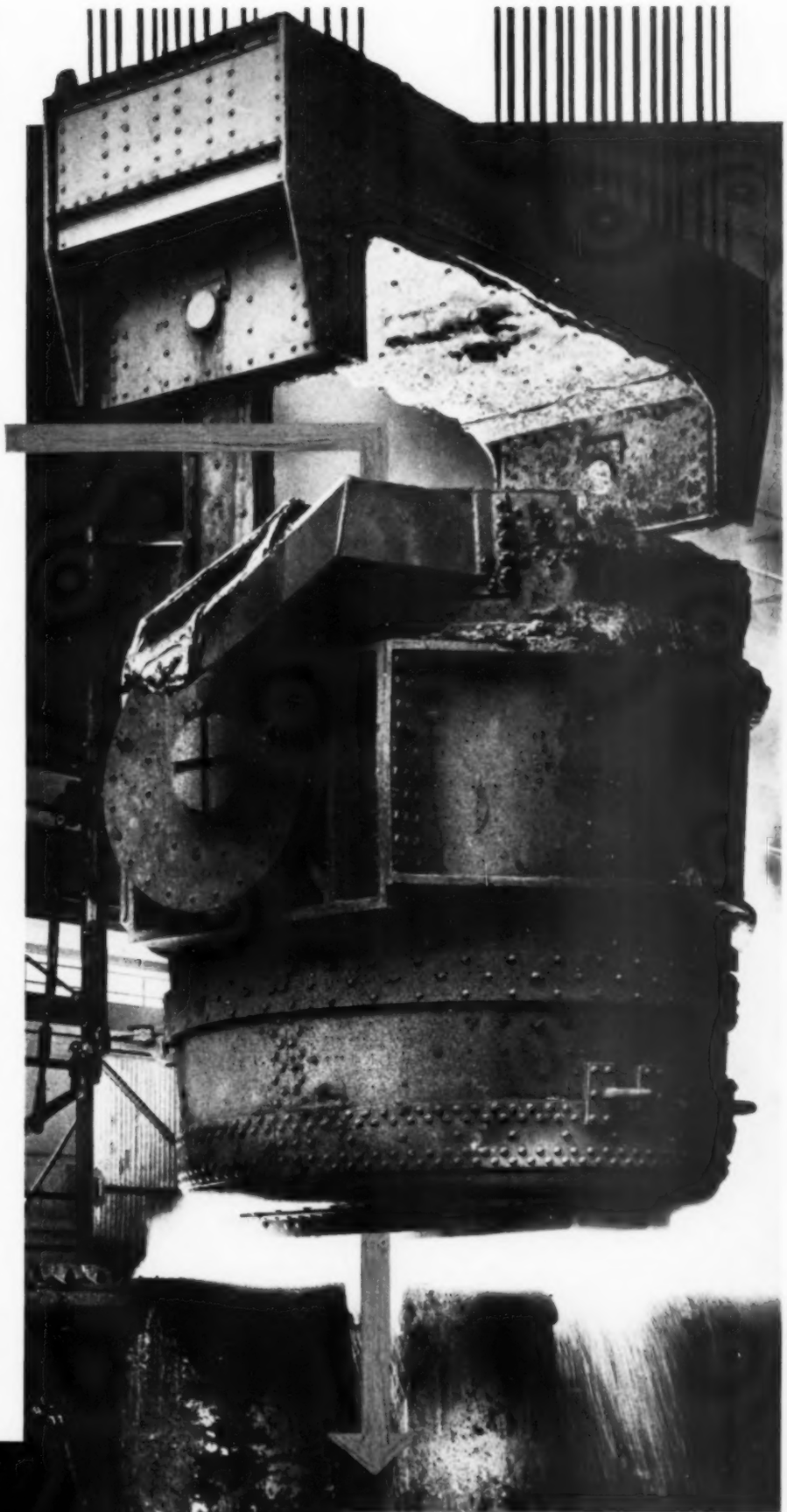
Reading

READING Foundrymen's Association held its fourth annual picnic and golf tournament at the Manor Golf Club, Fritztown, Pa., Saturday, June 28. The affair brought together over 400 foundrymen and their friends for a combination of fun, frolic and festivity unequaled in the history of the association. The annual outing has truly become the place where old friends in the industry meet in this part of the country. The entertainment committee has received congratulations from all sides for its efforts in putting over the affair. The fourth annual baseball game between the supply team captained by Jimmie Hatton, and the foundrymen, captained by Charley Mundell, for the Julian B. Greenstreet memorial trophy, was won by the foundry aggregation by the score of 5 to 2. Repeating last year's stellar performance, the foundrymen won a

(*Continued on page* 102)

Nearly 400 members and guests attended the annual outing of the Pittsburgh Foundrymen's Association held June 9 at Chartiers Heights Country club. Photos courtesy Sterling Farmer, Sand Products Corp., Cleveland

DEFENSE CALLS FOR PERFECT CORES AND CASTINGS!



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(*Continued from page* 100)
tight pitchers' duel by timely hitting in the pinches. Music was furnished all afternoon and evening by Lee Brailers orchestra.

Twenty-five handsome door prizes were presented to the holders of the lucky tickets. Fifteen prizes were awarded to the golf winners. John Ciabattoni, Reading Steel Casting division, American Chain & Cable Co., was winner of the low gross prize with a score of 70. The committee in charge of arrangements included: Chairman, Herman P. Good, William Davies, Len Bilger, Clarence Bates and Mac Moore.

The next regular meeting of the association will be held Sept. 16.—*H. C. Cummings, secretary.*

Conference Is Held In California

A joint regional conference of the Southern and Northern California Chapters was held on May 22 and 23 during the Western Metals Congress, Biltmore Hotel, Los Angeles. The sessions were well attended and more than 175 were present at the banquet of the foundry group which was held on the evening of May 23.

First session was held on Thursday morning, May 22, at which Dr. C. H. Lorig, Battelle Memorial Institute, Columbus, O., spoke on, "Low Alloy Steel Castings from Available Raw Materials." He stated that certain alloying elements which regularly have been used now are

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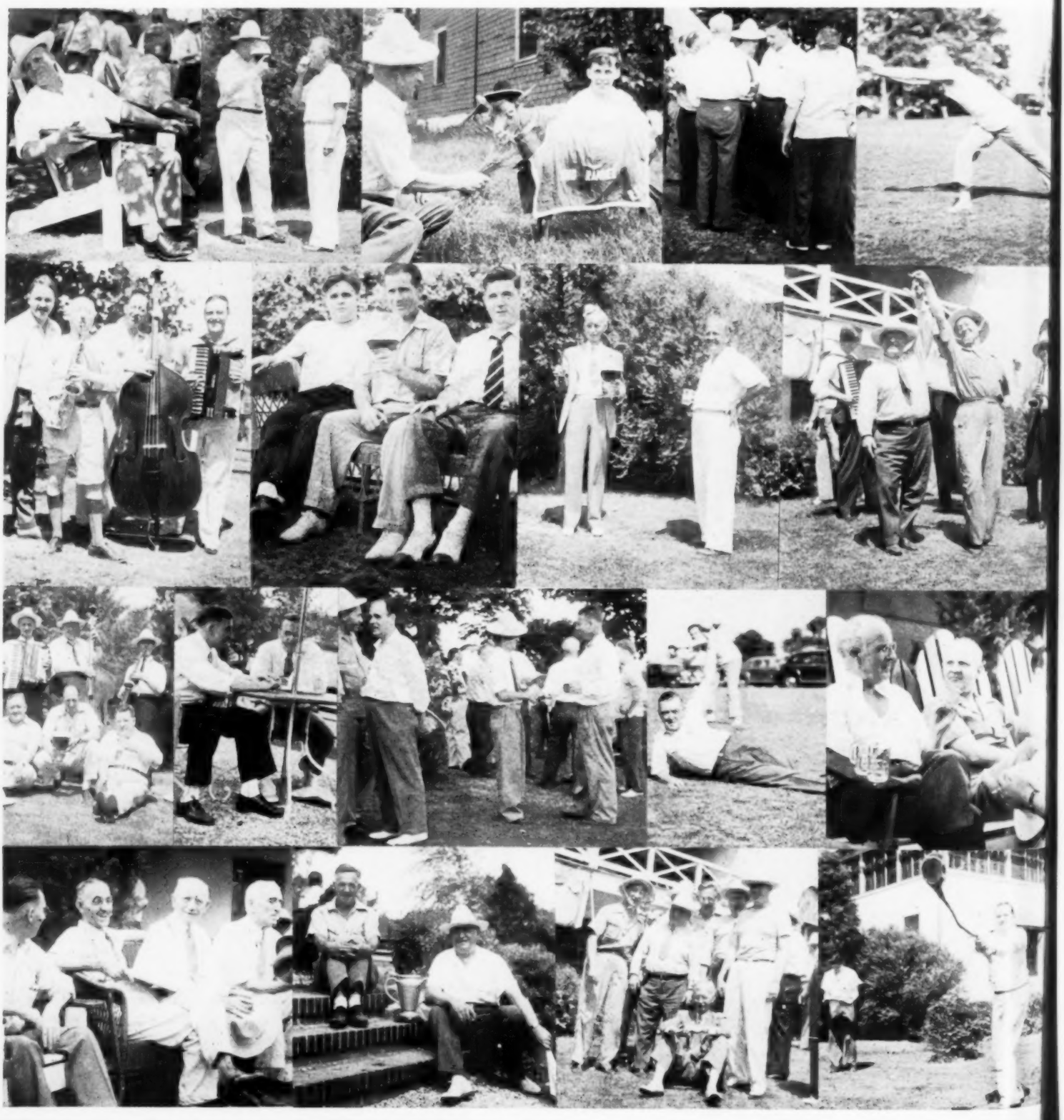
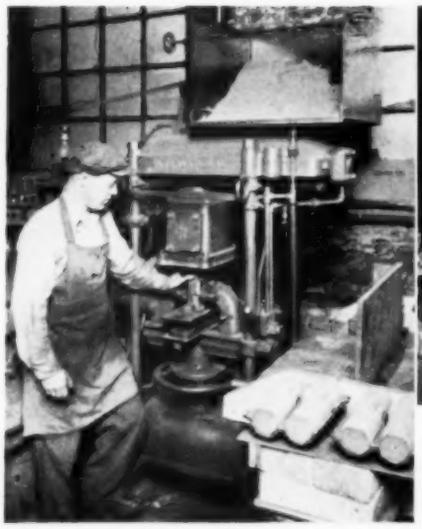
Reading Foundrymen's Association holds an outing. Photos courtesy H. C. Cummings





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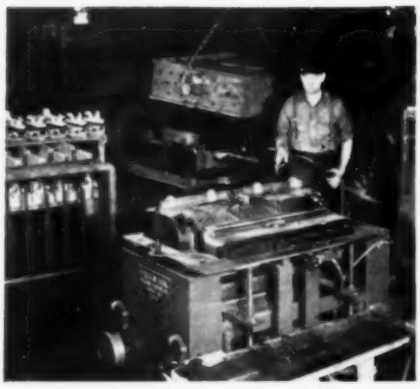

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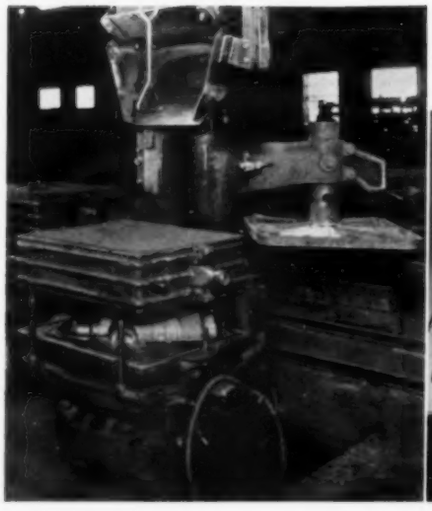
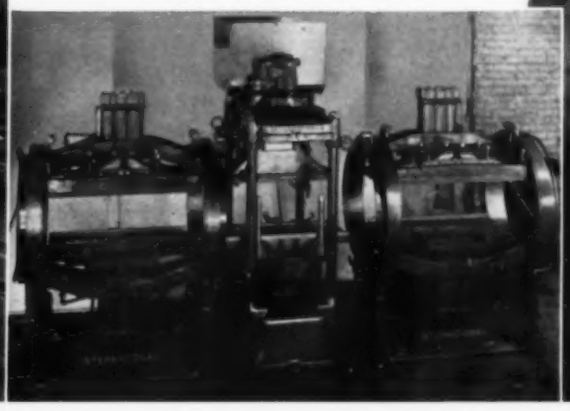




becoming limited which necessitates the substitution of other elements. Domestic alloys such as copper and molybdenum are being used in greater quantities for that purpose. With the change of alloying agents heat treatment procedure must be adjusted due to the difference in effect of the various alloys.

At the afternoon session, E. K. Smith, Electro Metallurgical Co., Detroit, spoke on "Foundry Control Methods in Making Uniform Cast Iron," in which he described some of the methods now being used to produce uniformly good castings, particularly by the cupola process. His discussion related to raw materials, cupola control equipment, cupola operation, use of chill tests, laboratory methods, ladle additions, etc.

On Friday morning, May 23, D. B. Reeder and L. N. Ludwig, Electro Metallurgical Co., New York, presented a paper on "Steel Castings" which discussed production phases of steel castings. Following that presentation E. L. Bartholomew, United Shoe Machinery Corp., Beverly, Mass., discussed, "The Heat Treatment of Cast Iron," and described the technique of austempering cast iron and the resultant physical properties of various castings.

At the afternoon session three papers were presented, by V. A. Crosby, Climax Molybdenum Co., Detroit, by C. W. Briggs, Steel Founders' Society of America, Cleveland, and by A. W. Winston, Dow Chemical Co., Bay City, Mich. Mr. Crosby's paper was entitled, "New Information on the Effects of Alloys on Iron." Mr. Briggs discussed steel foundry molding sands and Mr. Winston gave a brief review of the development of magnesium foundry practice covering core making, molding, melting, design etc.

Issues Letter on Aluminum Scrap

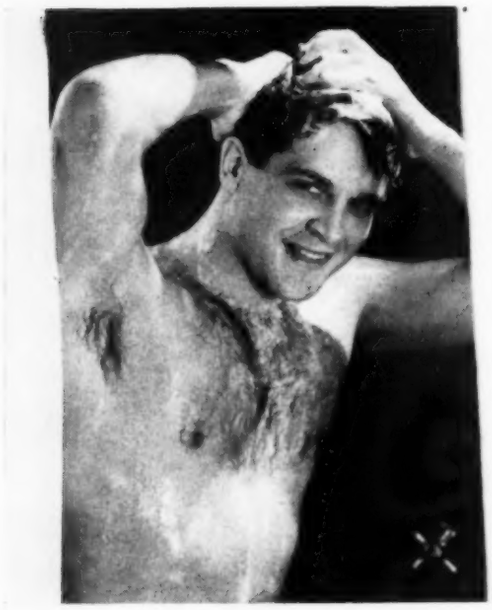
On July 11 E. R. Stettinius Jr., director of priorities, OPM, issued a letter to all aluminum foundries and melters and to all consumers of and dealers in aluminum scrap, stating that aluminum scrap may not be sold to producers except to those granted preference ratings of A-10 by the Priorities Division. Restrictions on the sale of aluminum scrap to processors are contained in supplementary order M-1-c issued June 10, 1941.

Following issuance of that order, the Director of Priorities specifically assigned an A-10 rating to a limited initial list of smelters. Therefore, only those who hold this rating are permitted to buy scrap for processing, although the order does not restrict the sale or transfer of scrap between dealers.

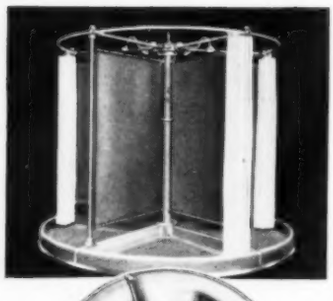
Since issuance of the M-1-c order, some smelters and others dealing in aluminum scrap apparently have misinterpreted its terms. There have been a number of cases in which it was assumed that the limitations imposed by the order applied only to deliveries for defense purposes, and that scrap could be sold to processors, without an A-10 rating, if it were intended for non-defense purposes.

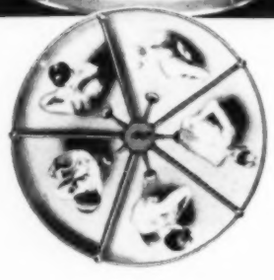
This interpretation is incorrect. Mr. Stettinius' letter on the point follows:

> Effective June 10, 1941, Supplementary Order No. M-1-c was issued by the Director of Priorities affecting deliveries of Aluminum Scrap.
>
> Under this Order all persons are prohibited from delivering or from receiving Aluminum Scrap for melting or otherwise processing, unless the proposed delivery has been authorized by the Director of Priorities in the manner provided in Supplementary Order No. M-1-c.
>
> All provisions of Supplementary Order No. M-1-c remain in force and any delivery of Aluminum Scrap, except in accordance with such Order, is unlawful.
>
> In any case where violation of orders issued by the Director of Priorities is known or suspected, the Director will take such action as he deems appropriate under the circumstances.



"Gee! But a Good Shower Keeps You Fit and Clean!"





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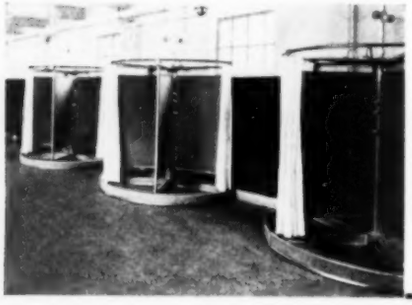

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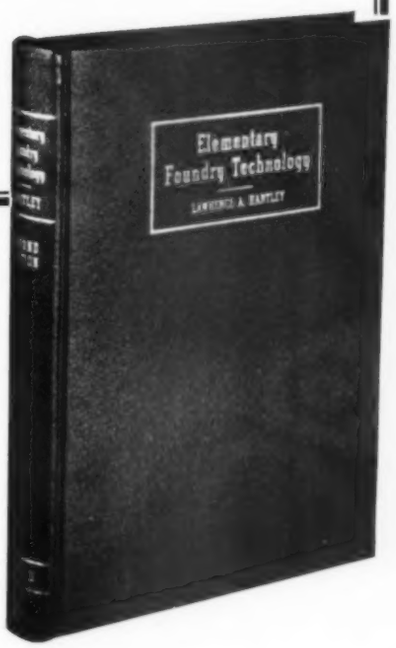

FUNDAMENTAL data on both foundry practices and those related subjects of importance to foundrymen are thoroughly covered for the use of apprentices and young men studying modern foundry management and operation.

This book, a fully revised second edition, contains material conforming to the requirements for instruction as set up in the minimum standards of four year foundry apprenticeship in the United States. It is sponsored by the National Founders Association, Chicago.

Well over half of the book is devoted to discussion of fundamentals of foundry practice, with special reference to the field of gray iron and steel manufacture. In this, the second edition, material has been revised and brought up-to-date to include much of the progress made in the foundry industry in recent years, and new sections have been added. Foundry subjects covered include . . . Elements of Iron . . . Iron Manufacture . . . The Cupola and Its Operation . . . Elementary Problems in Steel Foundry Production . . . Brass Melting . . . Foundry Sands . . . Gates and Risers . . . Molding Machines . . . Core Machines . . . Long Life Molds.

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CARRIES INSTRUCTION TO FOUNDRY

(*Continued from page* 69)

Hambrecht's visit a new idea of education for apprentices and journeymen, even in small Wisconsin communities, was conceived. The idea of bringing educational opportunities to workers of the smaller cities of the state through the medium of trade instructors traveling by automobile had its inception in 1924 when a plumber was hired for that purpose.

The underlying principle of all forms of vocational training in Wisconsin is such as will allow educational opportunities to all so called out-of-school groups, employed and unemployed, juvenile and adult, rural and urban. This article will be concerned chiefly with the educational privileges open to employed and unemployed foundry workers—journeymen and apprentices. To discuss the educational training provided for foundrymen it becomes necessary to discuss the circuit teaching movement because the greatest share of supplemental foundry instruction given in this state is that which is given through the circuit foundry instructors.

At the present time there are 24 circuit instructors giving service. They represent 13 fields of occupations or services not usually included in the local curriculum. There are two circuit instructors of foundry practice. Some of the services, other than foundry work, perhaps of direct interest to foundrymen are in the fields of industrial first aid, foremanship training and conference leading, and, possibly for a small group, sales training.

Each week the circuit instructor works out of a base city, invariably his home town which is located centrally in his work area. The area for each instructor is composed of a group of four or more cities (as adjacent as possible) interested in offering his work. Usually the area can be covered in one week. However, in some cases, two weeks are required to give complete service in the area laid out. There are three areas for some types of work. One of two for foundrymen is outlined in Table I.

Plan Appeals to Many

Circuit instructors not working with apprentices occasionally can serve in two or three cities daily if the cities lie conveniently adjacent. There is nothing fixed about the assignment of areas, each area is based on the needs for, and the nature of the work in the area. That of course requires considerable planning so that efficient and maximum service can be rendered. The entire circuit teaching program is integrated and co-ordinated by J. E. Tepoorten, occupational extension co-ordinator.

It is a smooth working plan very effective in its educational and industrial contacts for it reaches workers otherwise unable to receive such instruction; it reaches workers inert to the value of additional and continuous training; it reaches employers unaware of the program and the value to be derived from it; and it reaches employe groups who are unaware of its benefits or who may be skeptical of its aims.

The circuit teaching plan was devised also for the purpose of broadening the base of instructional opportunities for adult workers, journeymen and apprentices. It is obvious that it would be prohibitive, financially, for each city to supply instructors for all the specialized occupations in the community. However, the need for instruction is also obvious, and therefore, the local board of vocational and adult education, through its director, contracts with the state board of vocational and adult education for the services of a traveling trade-competent instructor. The cost of such instruction is shared by the several communities hiring the instructor and is reimbursable through state and federal funds. Spreading the cost in this manner imposes no hardship on any, and the service rendered is great in proportion to the cost.

Since the need for specialized instruction is limited in the smaller communities, the instructor works one day a week in each city of his circuit or one day every other week, depending upon the extent of instruction required and availability of instructors. It should be emphasized that the circuit teaching system covers the entire state with the exception of the city of Milwaukee where full time trade instructors are used. It should be emphasized also that the circuit teaching system does not overlap the existing vocational set ups of the 45 vocational centers in Wis-

Table II

Instruction Units

Assignments I to XXI

1. Raw Materials Used in Foundry Industry
2. Storage and Handling of Raw Material (Sand, Wood, Metals, etc.)
3. Core Making
4. Melting Gray Iron
5. Melting Steel
6. Melting Malleable Iron
7. Melting Aluminum
8. Melting Brass, Bronze, and Nickel Alloys
9. Melting Special Metals
10. Use of Patterns and Core Boxes
11. Molding (Bench)
12. Molding (Floor or Pit)
13. Molding (Machine)
14. Cleaning Castings
15. Repairing and Treating Castings
16. Seasoning Castings
17. Heat Treating Castings
18. Defects of Castings
19. Maintenance of Equipment
20. Safety
21. Foreman's Problems

Foundry Instructional Coverage Circuit "B"

Table I

August 15, 1940—June 15, 1941

Day	City	Workers from	Remarks
Monday	Waukesha	Waukesha Foundry Co. Spring City Foundry Quality Aluminum Foundry Co. General Malleable Corp.	Apprentices afternoons. Journeymen evenings
Alternate Monday	Beaver Dam	Malleable Iron Range Co. Kirsch Foundry Co.	As above
Tuesday	Kaukauna	Kaukauna Machine Corp.	Apprentices every afternoon. Journeymen evenings. 2nd period. 12 weeks
	Neenah-Menasha	Neenah Foundry Co.	Evenings only. Journeymen—1st period 12 weeks
	Appleton	Valley Iron Works Appleton Machine Co.	Evenings only. Journeymen 3rd period. 15 weeks
Wednesday	Oshkosh	Universal Foundry Co.	Apprentices afternoons. Journeymen evenings
Alternate Wednesday	Sheboygan	Sheboygan Foundry Co.	Apprentices, 8 hours every other week.
Thursday	Two Rivers	Becker Manufacturing Co.	Apprentices afternoon. Adults evenings. 1st 20 weeks
	Manitowoc	Wisconsin Aluminum Foundry Co. Manitowoc Foundry Co.	Apprentices afternoons. Adults evenings. 2nd 20 weeks
Friday	Area	NOTE: Among other things (See text) may include calls to outlying foundries for the purpose of inviting foundrymen to the nearest vocational center to participate in the work offered.	

consin, but dovetails into each one to make more complete the educational opportunities to all.

The circuit foundry instructor's day is divided into three periods: The morning is used for travel to the city in which he is to work, and is for such co-ordination work as may be necessary to carry on his program. He calls first on the local vocational school director to receive instructions or information relative to any conditions in the town affecting his program. Then he calls on local employers.

If given access to the foundry, and such permission under ordinary circumstances usually is given, he calls on apprentices, and journeymen members of his evening school group, or employes to whom he wishes to sell his program. The chief value here lies in the fact that the instructor becomes acquainted with the immediate educational needs of apprentices and journeymen, and can adjust his teaching program accordingly. By such periodic calls on employers and employes, the instructor also keeps on intimate speaking terms with his trade.

Table III

Unit III
Coremaking

A—Purpose of Cores
B—Kinds of Sand Used
  1. Silica
    (a) Uses
  2. Beach
    (a) Uses
  3. Dune
    (a) Uses
C—Sources of Core Sands
  1. Wisconsin
  2. Other Localities
D—Core Binders
  1. Purpose of binders
  2. Types of binders
    (a) Wet binders
    (b) Dry binders
  3. Theory of binders
    (a) Air dry
    (b) Heating
E—Core Sand Mixtures
  1. For light work
  2. For medium work
  3. For heavy work
F—Sand Treatment
G—Ramming Sand
H—Reinforcing Cores
I—Venting Cores
J—Baking Cores
K—Assembling Cores
L—Washing Cores
M—Handling of Cores
N—Core Dryers
O—Properties of Cores
P—Core Machines

Afternoons are given over to the instruction of indentured apprentices. The apprentice attends school 4 hours per week, or as in a few special instances, 8 hours every other week, for a total yearly minimum of 144 hours through the duration of his apprenticeship. This is in conformity with state and federal apprenticeship requirements. Apprentice and adult classes are held at the local vocational school but sometimes it is necessary and desirable to hold classes elsewhere. When the need arises, provision of other facilities is made by the school director.

Foundry instructional material for apprentices is under three headings: Foundry mathematics, foundry drawing, and foundry related information. Two prepared mimeographed units on foundry mathematics are used. The first is an elementary unit on basic mathematics. Problems deal with actual foundry situations. The advanced unit really is a combination of beginning blueprint reading and casting weight estimation.

Working sketches and pictorial sketches depicting different type castings are used throughout the booklet. The student is required to calculate the weight of castings from the information given. Problems can be made to apply to any metal, ferrous or nonferrous. One drawing unit is now being used. An advanced unit is in the state of

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preparation. The intention of the first unit is to get across some of the basic interpretations of blueprint reading.

Another purpose of this unit is to teach the simple principles of shop sketching. In speaking with employers a most frequent complaint is that the foremen can't make a reasonably clear sketch when a sketch would take the place of a long-winded description. One employer explained, "I have excellent foremen, but they would make themselves more valuable if they only could sketch occasionally. Why I have foremen come into my office telling me of plans to change gating systems in such a way that I have to take time off to go out into the shop to find out what they are talking about. A sketch would have saved the time for both of us."

Briefly, the course is presented through the use of mimeographed sheets of three and two-view working drawings. First block exercises are given, and then foundry parts such as mold weights, gaggers, molding machine parts, etc. The student is shown how to make mechanical or freehand sketches from these drawings.

The unit in preparation makes use of actual blueprints of contemplated castings. From the training received in the earlier unit the student easily can make a sketch of the object, and can picture the necessary gating when required to do so. To make an appropriate sketch he must learn to read every line on the print and that is the fundamental purpose of the whole drawing course—to avoid or eliminate at the outset disagreeable and costly mistakes occasionally made in industry because a blueprint was not studied completely.

Under related instruction is included text books, lecture outlines, and mimeographed information relative to the job of the apprentice in the foundry. When he is in the period of training where he is molding or core-making, or working on the cupola, his related technical instruction is directed along those channels. Lecture work is based on expanded outlines of the 21 foundry subjects shown in Table II.

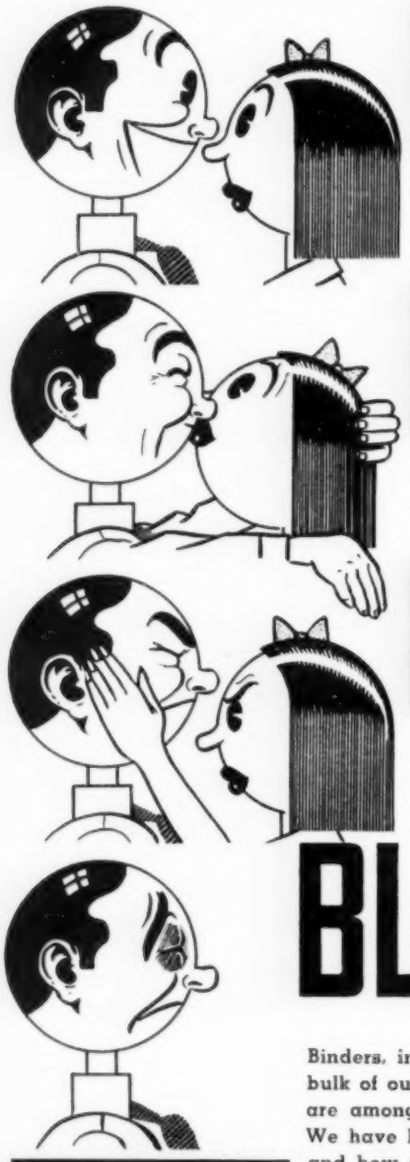
A partly expanded subject outline is shown in Table III. All outlines were made with the cooperation of foundrymen in some of the major foundry cities in Wisconsin and therefore are representative of the thought on the matter in this area. Here again we have strived to obtain information to satisfy the immediate needs of foundry workers —to build our educational courses to be of direct service and use.

Select Lecture Subjects

Subjects chosen for lectures are determined by the needs of local foundries. If the study group is predominately nonferrous, then the subjects akin to nonferrous founding are selected for lecture purposes. Outlines serve for both apprentices and journeymen, and are designed so that the lecturer can cover the subject in a general manner or in detail, according to the needs of those being lectured.

Related information also, may include foundry theories, techniques, and sciences. Some of the related material is being written by the foundry instructors to fill the need for specific information often missing in the foundry books on the market. Ultimately we intend to build much of our related informational course on the basis of the outline mentioned above. An important phase of related instruction consists of field trips made once or twice yearly, usually to several of the large foundries in Milwaukee.

Often industrial movies fill in gaps of related information not otherwise available. Apprentices are expected to answer questions based upon the picture. Film strips find great utility for related instruction. The author uses one in connection with gating which he made at the 1940 foundry show with the



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permission of R. E. Kennedy, secretary of the American Foundrymen's Association. It is a film strip of all the castings submitted by indentured apprentices in the national apprentice molding contest. Techniques in gating practice can be transmitted effectively in this way.

Where the schools have facilities, techniques of bench molding, false cheek molding, pattern plate making, hard sand match making, etc., are practiced. Little of that is done because it is felt that the apprentices receive instruction more completely on the job. Therefore, the work is largely supplemental. Also at some time during the school training period all apprentices are given a course in social problems which deal with apprenticeship law, labor regulations, social security, some of the problems involved in running a business, and insurance.

If the circuit foundry instructor's travel program is set up in such a way that he is unable to meet weekly with his apprentices he arranges with a specially designated local teacher to carry on the instruction during the alternate week. The alternate week educational program is formulated with the co-operation of local school officials and usually is based on instructional material prepared or designated by the circuit instructor so that at all times the lesson matter is closely akin to foundry practice.

Instructor Keeps in Touch

In some instances the trade instructor may not teach in a locality for a whole semester. In spite of that he does not lose touch with the apprentices and foundry instruction. He makes periodic check ups on all such written matter submitted by the apprentices which may be unfamiliar to the local instructor in charge. The check up is made on the circuit instructor's area day of which more will be mentioned later.

When the circuit instructor does not have direct contact with his apprentices for a whole semester, programs for apprentices where possible, are made up of pattern-making, general chemistry and physics, and social problems. One of the main purposes of all public instruction is to make useful citizens. That purpose must also be a part of apprenticeship instruction in order to make a well balanced individual. The apprentice's relationship to his fellow men may be brought out in the course on social problems, or it may be brought out by the foundry instructor in discussion sessions when the apprentice's relationship to his employer, foreman, and other employes, and how to get along with them, is discussed.

The third part of the circuit instructor's day is the evening trade extension program. Some foundrymen still frown upon the idea of attending night school in the belief that what they learn on the job is sufficient. That belief probably is true and no doubt is the reason why the conditions of their jobs never change to suit them. However, the vast majority today have come to realize that in order to be in line for promotion in position or salary, or both, they must have something to sell, and that something is the degree to which they can be of service to their employers.

The will to learn seldom goes unrecognized long. The value of continuous learning can be summed up in the words of Walter B. Pitkin's quotation: "He who cannot learn stands still. He who stands still goes backwards. He who goes backwards soon drops by the wayside, while men who can and will learn, learn to press onward."

Of necessity, to keep on producing high class castings today in a highly competitive industry, the man in the shop as well as his supervisor must keep abreast of every new theory, method, and practice. It is not sufficient that the supervisor alone gain technical information and knowledge.

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Inasmuch as the Wisconsin program brings educational opportunities to all, educational provision has been made for journeymen too. Part of the circuit instructor's job is to work with journeymen—molders, coremakers, and others.

The type of instruction for adults is as diverse as that which is given to foundry apprentices, and may include some of the phases of apprenticeship instructional material. The general practice though, is to omit book work, making the instruction in the form of analysis, such as listing the great variety of casting defects and molding difficulties, giving cause, effect, and responsibility; analyzing cupola troubles; analyzing core defects; etc.

Often defective castings are brought in from the local foundry for round table discussions. If sand testing equipment is available tests are made and the results are linked up with good and bad casting practice. Some groups are interested in elementary metallurgy and are served accordingly. On occasions experts are asked to give talks on special subjects such as foundry sands, core binders, foundry equipment and the like.

One more phase of the circuit instructor's work should be considered. Cases arise where it is desirable and necessary for the instructor to have an area day, to coordinate his program, coordination which otherwise could not be accomplished effectively during the regular course of apprentice and adult instruction. He also can carry on such duties as will aid in the better integration of his program as well as the whole circuit teaching program. The area day might be any day of the week. However, with the foundrymen, Friday has been assigned as area day. As time has proved, the area day has been a wise and far seeing step towards the continued fostering, promotion, and coordination of apprenticeship and trade extension programs. It has proven worthwhile to apprentices, journeymen, employers, and the schools, employe groups, and even indirectly to the American Foundrymen's Association.

Often when semester changes are made the circuit instructor may find it necessary to spend one or more days in the city contemplating a foundry instructional program. Doing this on an area day gives him sufficient time to ascertain the type of program which will satisfy the immediate educational needs of local foundrymen. In cities where no adult foundry work has been offered before, one or more of several approaches are used in acquainting foundrymen of the proposed educational program. Usually the local co-ordinator is in a position to lay the ground work for interview appointments. If or if not, the circuit instructor calls on the employer to explain the program.

Contact Employes Directly

It may be that the relationship between employer and employe is such that the recommendation of the employer is sufficient to assure a class. Sometimes it is necessary, sometimes the employer prefers, that the circuit instructor contact employes directly and individually; taking that means of interesting the worker in the value of the different programs for journeymen. It depends upon the size of the shop. In highly organized localities it may be judicial to seek the opportunity of addressing employe groups in their own assembly. Contact by newspaper and mail also is used.

In localities where a program has been in effect for a number of years, part of the area day is used for the purpose of meeting with advisory committees. Here valuable advice is received from employer and employe members for the purpose of constantly keeping the foundry education program up-to-date and effective.

On certain area days the circuit instructor calls on schools not being

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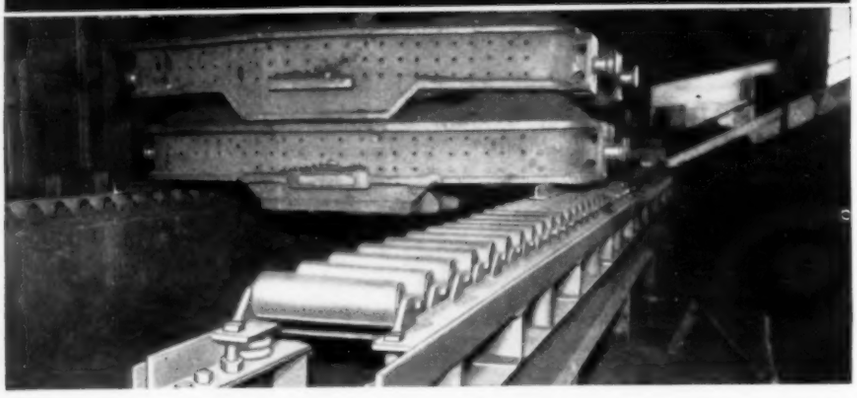

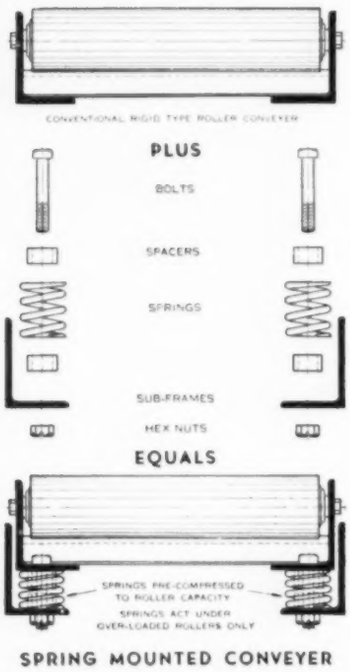

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served currently by him, to correct papers, check upon apprentices' work, make changes or additions to this program, etc. The area day affords the circuit instructors the opportunity of calling on employers and apprentices to see how the apprentices are getting along, to receive and give suggestions for the betterment of the training program.

Also, yearly, during the late winter and early spring months, the circuit foundry instructor supervises the apprentice molding contests for the American Foundrymen's Association in many of the foundries in cities outside of and distant from metropolitan area. That work has brought apprentices into the contests who otherwise were unaware of this fine educational phase of the association.

The apprenticeship program of the A. F. A. has been brought to the attention of non-company members, as well, in a few cases, to active members of the association. Foundries that lie outside the vocational centers are contacted for the purpose of learning the educational needs of the personnel and to sell the foundry training program, and to invite foundrymen to participate in the meetings in the vocational centers.

Used for Promotion

The area day is used to foster and promote apprenticeship; to familiarize any interested company of its aims, and to acquaint these companies of the existing agencies promoting and sponsoring it. Apprenticeship programs are formulated; prospective apprentices are interviewed, examined, and indentured. Fostering, promoting, and coordinating apprenticeship and adult educational programs—that is the key purpose of the area day.

Thus it can be seen that the instructional program offered through the circuit teaching movement is highly flexible. It is truly vocational in nature because it fills the immediate educational needs of workers in the trade—apprentices and journeymen. It serves a great number of communities otherwise unable to offer or afford live trade training. It is designed to expand further when trade training demands are made in communities not now served.

H. C. Beaver, president, Worthington Pump & Machinery Corp., Harrison, N. J., recently distributed more than 2800 lapel emblems to employes who had completed five years or more of service. Nearly half of the total workers employed were honored. Close to 200 of the group were in the 25 to 29-year class; 54 ranged from 30 to 39 years while 11 have been employed for over 50 years.

Issues Booklet

American Management Association, 330 West Forty-second street, New York, recently has issued a booklet in its production series which is entitled, "Selection and Development of Foremen and Workers." The following papers are included: "Which Men Will Make the Best Foremen," by Stewart M. Lowry, director of industrial relations, Procter & Gamble Co.; "Developing Effective Supervision," by Wendell M. Nelson, assistant to the manager of the Schenectady Works, General Electric Co., Schenectady, N. Y.; "The Foreman's Own Point of View," by A. C. Horrocks, president, National Association of Foremen, Goodyear Tire & Rubber Co., Akron, O.; "The Right Man for the Right Job," by George H. Prudden, works manager, Vega Airplane Co.; "New Developments in the Selection of Factory Workers," by Charles A. Drake, consulting industrial psychologist, Johnson and Johnson. The booklet may be obtained from the association for 75 cents.

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PISTON RINGS FOR AIRCRAFT

(*Continued from page 53*)

course, purely arbitrary though they do demonstrate that the piston-ring gray iron structure saves the cylinder from both surface mutilation (scuffing, scoring, etc.) and holds its wear to a minimum. That seems confirmed by actual field results.

Large military aircraft engines of 1000 horsepower and over usually use five to six rings on each piston. The pistons are of forged aluminum alloys and differ again from automotive engine pistons in that the diameter often is greater than the length. Most pistons have grooves machined for rings of 3/32-inch thickness, and there is only a limited space between the ring grooves due to the short piston length mentioned.

Excessive piston groove wear, in addition to being costly from the standpoint of piston renewal, also reflects unfavorably on engine performance. Cast iron rings appear to hold groove wear to a minimum, as the metal combination—cast iron versus aluminum—is a reasonably *compatible* wear assembly. To retard piston groove wear further, aircraft rings are finished with lapped sides to a surface smoothness of 2 to 4 microinches.

To prevent piston seizure under full power operation, the aluminum pistons must be fitted loosely to allow for thermal expansion. That means that the rings—beside sealing combustion and controlling oil—also act to centralize or stabilize the piston in the cylinder. Then again the cylinder itself, being relatively thin, distorts to some extent due to power and thermal effects (they are said to pulsate with each explosion).

Such actions subject the rings to *cold working* or *pounding* effects on their outer periphery which tends to cause the ring to collapse or lose its outward tension. This tendency to lose tension also results from the inertia forces of the ring, moving from top to bottom of its groove with piston reciprocation.

Here again the structural and physical properties of cast iron resist to a marked degree the *peening* or *setting* actions mentioned previously. Some steel compositions, though possessing greater strength and metal density, show increased tendency to collapse, or tension loss, under such conditions.

Though gray cast iron lacks the toughness and high strength of other ferrous alloys, it nevertheless possesses certain properties peculiar to itself which seem well adapted for piston ring requirements. Its ability to be cast in suitable shape to satisfy engineering requirements — its desirable wear properties such as quick seating, anti-seizing, and compatibility with other materials—its elastic or spring qualities, retained under engine temperatures—and other compensating properties amply justify its use for piston ring purposes.

It may be that this article will be taken as a defense of cast iron against other materials, and this is not entirely denied. It is realized that in some cases steel rings have given quite satisfactory performance in aircraft engines even as

Wear Weight Loss

	Brinell	Cylinder Wear Mgm.	Ring Wear Mgm.	Surface
Piston Ring Iron	260	7.0	138	Smooth
Specimen "C" Cast Iron.	190	11.0	75	Scuffed Scored
Rolled Steel.	270	22.5	42.5	Scuffed Scored

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they have in those for automotive use. Undoubtedly, there is a need for a composition having higher physical properties — but — these must not be obtained by sacrifice of other basic requirements some of which have been covered herein. Meanwhile, this once considered *lowly* gray cast iron continues to play a vital part in the important job of keeping American aircraft engines the best in the world.

To Hold Congress

Importance of metals to the national defense program will be the general theme of the National Metal Congress and Exhibition to be held in Philadelphia beginning Oct. 20, according to W. H. Eisenman, director of the Metal Congress and secretary of the American Society for Metals, which sponsors the show. The congress is held in conjunction with the annual meetings of the American Society for Metals, the American Welding Society, the Wire Association and the Institute of Metals division and the Iron and Steel division of the American Institute of Mining and Metallurgical Engineers. Technical sessions of the various groups will be held in downtown Philadelphia hotels during the five-day sessions of the congress.

Represents Firm

American Engineering Co., Philadelphia, has appointed George C. Lever Co., 50 Church street, New York, and 972 Broad street, Newark, N. J., to represent the firm in northern New Jersey, greater New York and Long Island; George J. Sturmfelsz, 1208 Southview road, Baltimore, as sales representative in the state of Maryland; H. E. Mensch, 424 Book building, Detroit, as sales representative in the Detroit territory and American Steel Export Co., 347 Madison avenue, New York, as foreign sales representative for the company's electric hoist.

Broadcasts News

Dougherty Lumber Co., Cleveland, recently entered the field of radio broadcasting for both merchandising and institutional promotion. The Dougherty concern is sponsoring a nightly news feature on radio station WHK, Cleveland, entitled, "World News with Murray Young." The program is scheduled for 15 minutes Monday through Friday at 11 p. m.

Industrial Recreation, Its Development and Present Status is the title of a monograph prepared and released at Purdue University, Lafayette, Ind. It was written by Leonard J. Diehl and Floyd R. Eastwood, and points out that outstanding values accruing from industrial recreation are improvement of employer-employe relations, better interdepartmental co-operation and fellowship, better use of energy during free time, and means of developing physical and mental fitness.

Farrel-Birmingham Co. Inc., Ansonia, Conn., has issued booklet No. 40 in its current series which is entitled, "What Will Peace Bring?" The study outlines briefly some of the problems and the opportunities of the postwar period as they may affect the United States, including price readjustment, future armament expenditures, the national policy of imperialism and the outlook for industry.

"Labor in the Defense Crisis" is the title of the most recent pamphlets published by the Public Affairs Committee Inc., 30 Rockefeller Plaza, New York, written by T. R. Carskadon and available for 10 cents a copy. Questions discussed include: Will defense production absorb the unemployed; should defense strikes be outlawed; how can labor disputes be settled?

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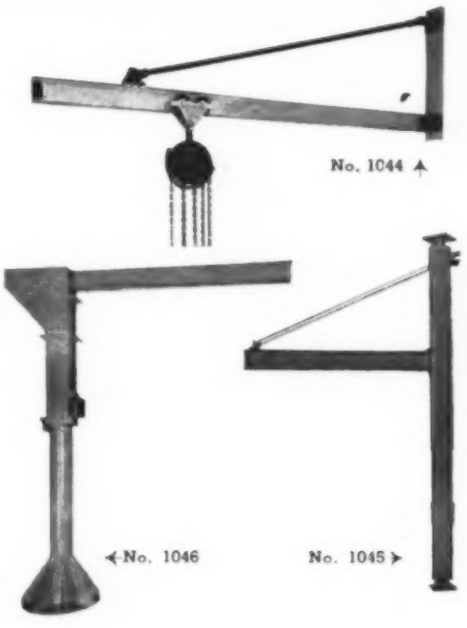

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CONSTRUCTING A SMALL CUPOLA

(*Concluded from page 67*)

tuyeres as shown in the figure.

The breast opening is 4 x 7½ inches and filled with plastic fire brick to make a tap hole ½-inch deep, ¾-inch in diameter, and 1 inch above bottom of the spout. The spout is made of ¼-inch steel, lined with a 1¼-inch thickness of fire brick. The slag-hole is located at the side of the cupola half way between the tuyeres. It consists of a 4 x 5½ inch oval in the shell and lining, filled with plastic fire brick to form the slag hole 1 inch in diameter. For the position of the tuyeres shown in the drawing, the slag hole is 9 inches above the bottom plate.

Charging is done from the top of the furnace. A hopper and funnel, as shown in Fig. 1 aid in changing. An inverted funnel above the furnace acts as a spark arrester and a means of smoke disposal.

The lining of the cupola consists of tiers of standard arch fire brick, each tier containing 20 No. 2-arch and 9 No. 3-arch bricks to give the inside diameter of 15 inches.

Air is supplied by a constant pressure centrifugal blower at the rate of 350 cubic feet per minute and from 4 to 10 ounces per square inch pressure. The blower is equipped with a damper. The amount of air supplied to the cupola is indicated by a calibrated ammeter connected in series with the blower motor.

This 15-inch cupola furnace has a normal melting rate of 30 pounds per minute or 1800 pounds per hour and usually is required to melt 3600 pounds for a heat. This melting rate results in 120-pound taps of low carbon iron every 4 minutes; or 150-pound taps of medium carbon cast iron every 5 minutes; or 180-pound taps of high carbon cast iron every 6 minutes. The largest single tap which can be taken from this furnace is a 210-pound tap using a 7 minute tapping schedule.

After each heat the lining of the cupola at the melting zone is cleaned of slag and patched with plastic fire brick similar to that used for the slag hole and breast. The sand bottom consists of a mixture of half molding sand and half core sand, and is rammed to a thickness of 3 inches by means of a floor rammer. After the sand bottom has been rammed in, a clay gasket is placed on top of the lower half of the cupola and the top half is lifted into place.

Light Fire in Cupola

Shavings of wood are first placed in the cupola and ignited. Dry wood is then added to a height of 10 inches above the tuyeres. When the fire is well developed, 20 pounds of coke are placed on the wood; and when this coke has ignited, more coke is added in 15-pound charges until the correct height is obtained. Three pounds of limestone are added with each 15-pound charge of bed coke. The fire is allowed to burn through each layer of coke before adding the next layer. The coke bed height above the tuyeres is determined from the wind belt pressure by the equation:

$$H = 10\tfrac{1}{2}\sqrt{P} + 6$$

where H = height of bed above tuyeres in inches, and P = wind belt pressure in ounces per square inch.

This bed is allowed to soak for a period of not less than 3½ hours and not longer than 4 hours. During the soaking period the tuyeres are left open, and since there is no stack on the top of the cupola furnace, this allows just enough air to be supplied to the bed to keep the bed ignited and to assure complete burning through.

If the first two layers of coke in the bed do not ignite rapidly, a ¾-inch gas pipe, which is plugged

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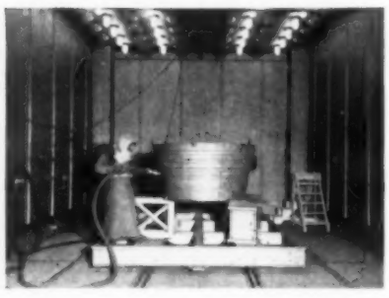

BLAST CLEANING ROOMS

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CLEVELAND, OHIO

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at one end and drilled with a large number of small holes, is inserted through the tap hole and connected to a compressed air line. After the soaking period has been completed, the coke bed is leveled off to the correct height and the metal and coke charges are added.

The weights of the charges are shown in the accompanying table. The charges are arranged so that the metal charge is placed on the bed, followed by a coke split or charge. The limestone is placed in the center of each coke split. Charges containing steel are arranged so that the steel is placed on the top of the coke split, followed by pig iron and scrap iron.

A 2½ x 2½ x 3-inch or a 3 x 3 x 3-inch coke has been found to produce satisfactory results in this small cupola. The largest size of either steel or scrap iron is limited to 5 inches.

As soon as the cupola is filled, the blower is started, and the blast gate adjusted to deliver 350 cubic feet of air per minute to the cupola. This amount of air is delivered to the cupola throughout the entire run. At this rate input of air and with the correct bed height, the cupola shows molten iron at the tap-hole 8 minutes after the blast has been turned on.

Control Carbon Content

As soon as the molten iron appears at the tap-hole, the tap-hole is plugged with a clay bott and melting is continued. A definite tapping schedule is arranged in advance, depending upon what carbon analysis is desired in the iron at the cupola spout. The tapping for low carbon high strength iron usually is scheduled at 4-minute intervals between the time the bott is placed in and removed from the tap-hole.

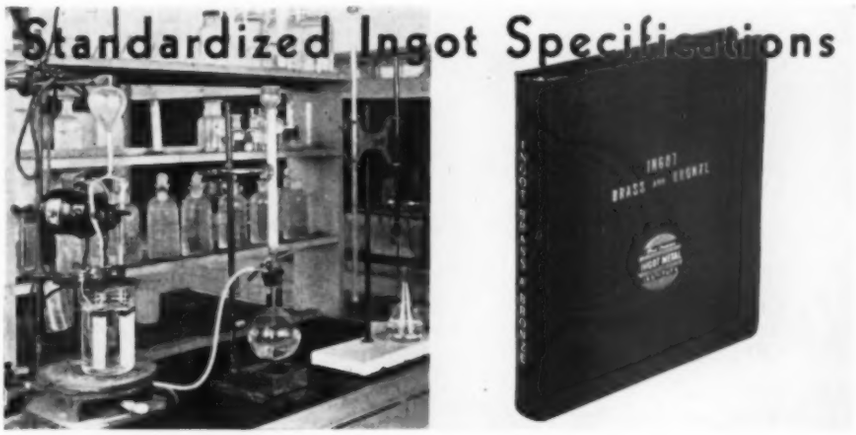
By using a definite tapping schedule, the carbon analysis is controlled to plus or minus 5 points. For high carbon cast iron the tapping schedule may be as long as seven minutes between "bott in" and "bott out". The slag hole is kept closed until after the fifth tap and then is opened allowing some slag to drain out. With a definite tapping schedule, a certain amount of slag is always left in the cupola furnace which gives a very clean iron free from dirt and other impurities.

Once the slag hole has been opened, it is allowed to close itself with frozen slag which (as soon as the slag level comes up to the slag hole) reopens itself automatically, and usually does not require any further attention for the duration of the heat. The slag leaving the cupola is allowed to run in large pails of water which pulverizes the slag, and also eliminates hot slag being left around the cupola floor. The tuyeres are cleaned out after an hour and a half operation.

After the required amount of iron needed for the day's heat has been charged into the cupola, an additional charge of 200 pounds of heavy scrap is placed on the top of the last metal charge. This scrap is not melted but is used only to absorb the heat from the lining, thereby decreasing the amount of patching required after each run.

When the requirements for molten metal have been met, the operation of the cupola is discontinued immediately by stopping the blower. The molten metal is first drained from the crucible through the tap hole; then the remaining materials are allowed to drop out when the prop which supports the bottom doors is pulled away. A stream of water from the sprinkling system is directed on to the pile of burning coke, slag, and unmelted metal.

This small cupola has worked very satisfactorily during the past year and has given close control of carbon, silicon, and manganese analyses of the iron. It has produced cast iron with a tensile strength as high as 45,000 pounds per square inch using only 30 per cent steel in the charge and no alloy addition, and as high as 60,000 pounds tensile strength per square inch with less than 1 per cent alloy additions.



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Ajax Anti-Acid Bronze
Ajax Phosphor Bronze
Ajax Red Brass Ingots
Ajax Manganese Bronze
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Ajax Golden Glow Yellow Brass
Ajax Nickel-Copper 50-50%
Ajax Manganese Copper
Ajax Aluminum Alloys
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AJAX ELECTRIC COMPANY, INC., *Electric Salt Bath Furnaces*

Using a 50 per cent steel charge in the furnace, and the balance silvery pig and scrap, carbon analyses as low as 2.45 per cent and silicon analyss of 3.00 per cent have been obtained giving a very dense cast iron easily machined with a tensile strength of about 45,000 pounds per square inch. This cupola can produce cast iron as low as 2.20 per cent carbon without any difficulty arising. The temperature at the spout for high carbon soft iron averages better than 2650 degrees Fahr., and with low carbon high strength cast iron averages 2750 degrees Fahr. Temperatures are measured with an immersion thermocouple developed by the author.

At the present time this cupola is being used in connection with a government research project "A Study of the Control of Cupola and Duplex Cast Iron During Melting and the Effects of this Control on the Properties of the Cast Iron". The layout of equipment that is used in connection with this cupola is shown diagrammatically in Fig. 5.

It includes a Spencer Turbo compressor, a Hays' CO_2 analyzer and recorder with compensator, a Hays' flow control with compensating motor, a Hays electric power damper member, a Hays' wind belt pressure recorder, a Hays' thin plate orifice and air volume recorder, an Ashcroft wind belt pressure gage, an Ellison inclined draft gage, a set of Hays' soot and mixing filters, a Bryant 800 cubic feet per minute dehumidifier, a General Electric alternating current ammeter calibrated in cubic feet per minute, and miscellaneous wet and dry bulb thermometers, thermocouples, and potentiometers. Most of this equipment has been loaned or given to the University of Minnesota by different industries which have shown interest in this research project.

In the schematic drawing Fig. 5 the various parts are indicated as follows: Cupola *A*, blower *B*, dehumidifier *C*, wet air intake *D*, air filters *E*, activation exhaust *F*, dry air outlet *G*, wet and dry bulb thermocouples *H*, blower intake manometer *I*, blast gate *J*, electric power unit, *K*, machined blast pipe *L*, thin plate orifice *M*, wind belt *N*, tuyeres *O*, sampling tubes *P*, soot filters *Q*, gas pressure regulator *R*, carbon dioxide analyzer *S*, carbon dioxide recorder and compensator *T*, air flow recorder *U*, air flow control and compensator *V*, gas pressure manometer *W*, wind belt pressure gage *X*, wind belt pressure recorder *Y*, and motor ammeter *Z*.

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Gives Attention to Defense Problems

Co-ordination of the industrial and federal materials specifications and the development of adequate substitutes for critical materials to facilitate the national defense program attracted close attention at the forty-fourth annual meeting of the American Society for Testing Materials held at the Palmer House, Chicago, on June 23 to 27. Attendance at the meeting struck a new high with 1540 registered for the week.

In his presidential address at the opening session on Tuesday morning, President Barr pointed out that in the existing national emergency and in the years ahead, the safety of this nation and the future of our whole economic life will be determined by the work of the research scientist and the production engineer. He also stated that services of the society have been offered to the government and are being used to advantage.

C. L. Warwick, secretary-treasurer of the society in the annual report of the executive committee said that while in 1917 there were only 133 A. S. T. M. specifications, methods and definitions, now there are 952. The report also recommended more direct co-operation with federal bodies in the early stages of specification writing so that it will be possible to facilitate

inclusion of requirements in A. S. T. M. specifications to cover government procurement; to inform federal specification committees of the considerations underlying present requirements in A. S. T. M. specifications and of the status of new specification work in progress; and in general to make available to them the wealth of information and data on specifications and tests in the hands of A. S. T. M. committees. Mr. Warwick stated that membership in the society was 4470, an all-time high.

Announcement was made that next year's Spring and group committee meetings will be held at Cleveland on March 2 to 6, and the annual meeting at Atlantic City, N. J., on June 22 to 26. At the conclusion of the session the newly elected officers were introduced as follows: President, G. E. F. Lundell, chief, chemistry division, National Bureau of Standards, Washington; vice president, Dean Harvey, materials engineer, Engineering Laboratories and Standards department, Westinghouse Electric Mfg. Co., East Pittsburgh, Pa.; members of the executive committee—A. W. Carpenter, manager of testing laboratories, B. F. Goodrich Co., Akron, O.; T. A. Fitch, director, Bureau of Standards, City of Los Angeles, Calif.; C. D. Hocker, plant products engineer, Bell Telephone Laboratories, New York; J. L. Miner, director and vice president, Atlas Lumnite Cement Co., New York, and E. W. Upham, chief metallurgist, Chrysler Corp., Detroit.

Revisions Recommended

In the report of Committee B-7 on light metals and alloys, cast and wrought, a number of revisions were recommended in several tentative specifications to bring them into line with present commercial practices and to meet a consumer demand for products which have not been covered previously. A new high strength aluminum and casting alloy not requiring solution treatment and quench was added to tentative specification B27-37T. It contains 4.80 to 5.70 per cent zinc, 0.40 to 0.60 per cent chromium, 0.40 to 0.60 per cent magnesium, 0.10 to 0.25 per cent titanium, 1.00 per cent maximum iron, 0.20 per cent maximum copper, 0.60 per cent maximum silicon, and remainder aluminum. In the as-cast, unaged state the tensile strength is 29,000 pounds per square inch, yield strength is 16,000 pounds per square inch, and the elongation minimum in 2 inches is 6 per cent.

Report of Committee B-5 on copper and copper alloys, cast and wrought, recommended several new specifications and methods to be accepted for publication as tentative standards. These include tin bronze and leaded tin bronze sand castings to replace immediately the standard specifications of the alloy in copper 88 per cent, tin 8 per cent, zinc 4 per cent (B60-36), and for steam or valve bronze castings (B61-40) which are recommended for withdrawal; leaded red brass and leaded semired brass sand castings to replace immediately the standard specifications for composition brass or ounce metal castings (B62-36) which are recommended for withdrawal; leaded brass sand castings for general purposes; high strength yellow brass and high strength leaded yellow brass sand castings to replace immediately the standard specifications for manganese bronze sand castings (B56-39), including the tentative revision published since 1939, which are recommended for withdrawal; aluminum bronze sand castings, to replace immediately the standard specifications for aluminum bronze castings (B59-39), which are recommended for withdrawal; and leaded nickel brass (leaded nickel silver) and leaded nickel bronze (leaded nickel silver) sand castings.

In report of Committee D-5 on coal and coke, subcommittee VIII on foundry coke specifications has been discontinued since it does not seem to be feasible to prepare gen-

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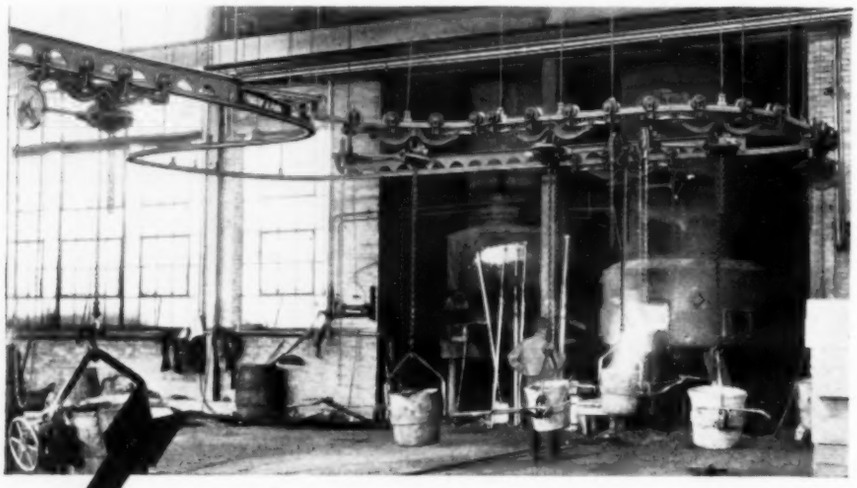
eral specifications covering foundry coke. The present standard specifications for foundry coke (D17-16) are being withdrawn as they have outlived their usefulness.

In a paper entitled, "Addition of Bismuth for Producing Free-Machining Stainless Steels" by H. Pray, R. S. Peoples, and F. W. Fink, all of the Battelle Memorial Institute, Columbus, O., it was pointed out that small additions of bismuth on the order of 0.2 to 0.26 per cent to the cast chromium and chrome-nickel alloys with or without molybdenum, columbium, titanium, etc., improved machinability considerably without affecting the mechanical properties to any important degree. Additions also improved galling resistance, do not injure weldability and in general assert no deleterious effect on corrosion resistance.

The final meeting on iron was held on Friday. Committee A-7 on malleable iron castings withdrew its recommendations that the words *yield point* appearing in the specification for malleable iron be changed to yield strength. Committee A-3 on cast iron recommended that the tentative specification for cast iron pit cast pipe for water and other liquids (A44-39T) be approved without revision for adoption as a standard specification. The report also contained a proposed tentative recommended practice for evaluating the microstructure of graphite in gray iron which contains two large charts showing types of graphite flakes and also graphite flake size, and includes the recommended procedure for polishing microsection of cast iron. Other papers presented at the session were: "Strain Hardening of Gray Cast Iron," by John Sanford Peck, assistant professor of civil engineering, College of the City of New York; "Fatigue and Static Load Tests of High-Strength Cast Iron at Elevated Temperatures," by W. Leighton Collins, assistant professor and James O. Smith, instructor, University of Illinois, Urbana, Ill.; and "Young's Modulus of Elasticity and Some Related Properties of Graphitic Materials," by H. A. Schwartz, manager of research, and C. H. Junge, research metallurgist, National Malleable & Steel Castings Co., Cleveland.



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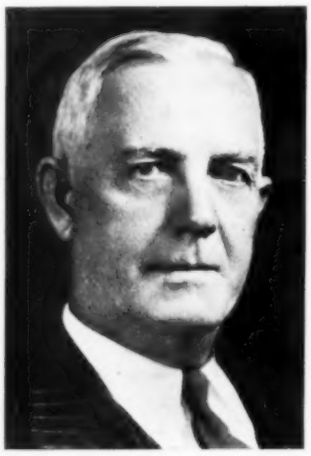
Magnetic Separator

Stearns Magnetic Mfg. Co., Milwaukee, announces some unusual improvements in the design and construction of the spout type magnetic separator. The spout magnets have been streamlined, modernized and simplified and now operate with fewer parts than former models. According to the manufacturer, exacting tests show that the improved magnets provide a deeper, stronger and more powerful magnetic field than formerly. Magnet coils are protected by aluminum plates in which spacious louvers allow ample ventilation, but prevent the entrance of dirt or other foreign material. The former gate opening bar has been replaced by a simple arrangement of toggle plate which opens and closes the safety gate automatically as the current is turned on or off. . .Improvements for alternating current operation include a new type rectifier, a more compact trouble free unit than the former type. It is less susceptible to damage from dust, dirt or atmospheric conditions. The new type spout magnet is available in sizes from 8 to 20 inches wide and operates from 110 to 220 volt alternating or direct current. A junior type unit is available for small installations.

Herman Nelson Corp., Moline, Ill., recently purchased the Autovent Fan & Blower Co., Chicago The business will be operated as the Autovent Fan & Blower division of the Herman Nelson Corp., and the complete line of Autovent products will continue to be manufactured by that division in Chicago.

Obituary

WILLIAM OBERHELMAN, 66, vice president of Hill & Griffith Co., Cincinnati, manager of its southern branch at Birmingham, Ala., died June 28 at his home in Birmingham. He was



William Oberhelman

born in Cincinnati and at an early age commenced working for the Hill & Griffith Co. After 5 years he was transferred to Birmingham and lived there for the past 42 years. Of an exceptionally social and genial disposition, he was widely known and greatly respected throughout the Southern foundry industry. Up to 2 years ago when he became ill through heart disease, he was prominently identified with many social, business, sport and fraternal organizations. He had an active part in the formation of and was a charter member of the Birmingham Chapter of the American Foundrymen's Association.

* * *

C. J. G. Fischer, 82, founder, Fischer Casting Co., North Plainfield, N. J., and well known brass and aluminum foundryman in the New York area, died June 29.

* * *

Victor A. Harder, 72, for many years associated with the Central Foundry Co., 386 Fourth avenue, New York, died recently at his home in that city.

* * *

E. C. Edmundson, retired vice president and general manager, Williams & Co. Inc., Pittsburgh, died recently at his home in that city. Mr. Edmundson retired May 1 after 20 years with the company.

* * *

William W. Wilcox, 79, chairman of the board, Wilcox, Crittenden & Co., Middletown, Conn., manufacturer of marine hardware, died recently at his home in that city. Mr. Wilcox first became a shipping clerk for the company, which was founded by the members of his family in 1847, and worked in all departments before being elected president in 1917. He was made chairman when he retired from the presidency in November, 1940.

* * *

John H. Berryhill, 62, for 25 years associated with the Vulcan Plow Co., Evansville, Ind., as superintendent and factory manager until his retirement in 1926, died in Evanston, Ill., June 15. Mr. Berryhill was a mechanical engineer graduated from Purdue University in 1900.

* * *

Gus Nelson, superintendent of the pipe shop, Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., died recently in a hospital in that city. Mr. Nelson had been an employe of the Tennessee company for more than 30 years.

* * *

Arthur C. Smith, 61, for the past 16 years foundry superintendent Hardie-Tynes Co., Birmingham, Ala., died at his home in that city June 16 after an illness of four

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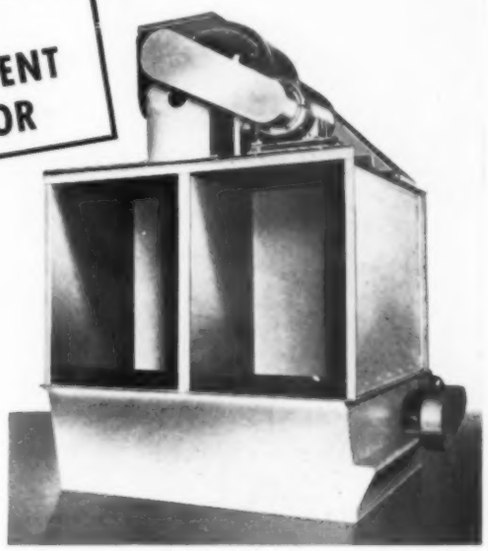

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days. He was born in Easton, Pa., educated in the public schools and served an apprenticeship with his father Philip C. Smith, long time foundry superintendent Ingersoll-Rand Co., Phillipsburg, N. J. He succeeded his father as foundry superintendent, later held a similar position in the Richmond, Va., plant of the American Locomotive Co., before going to Birmingham. In his younger days he was a prominent football and baseball player and always kept up his interest in athletics. Everett E. Smith, a brother, is foundry manager A. B. Farquhar Co., York, Pa.

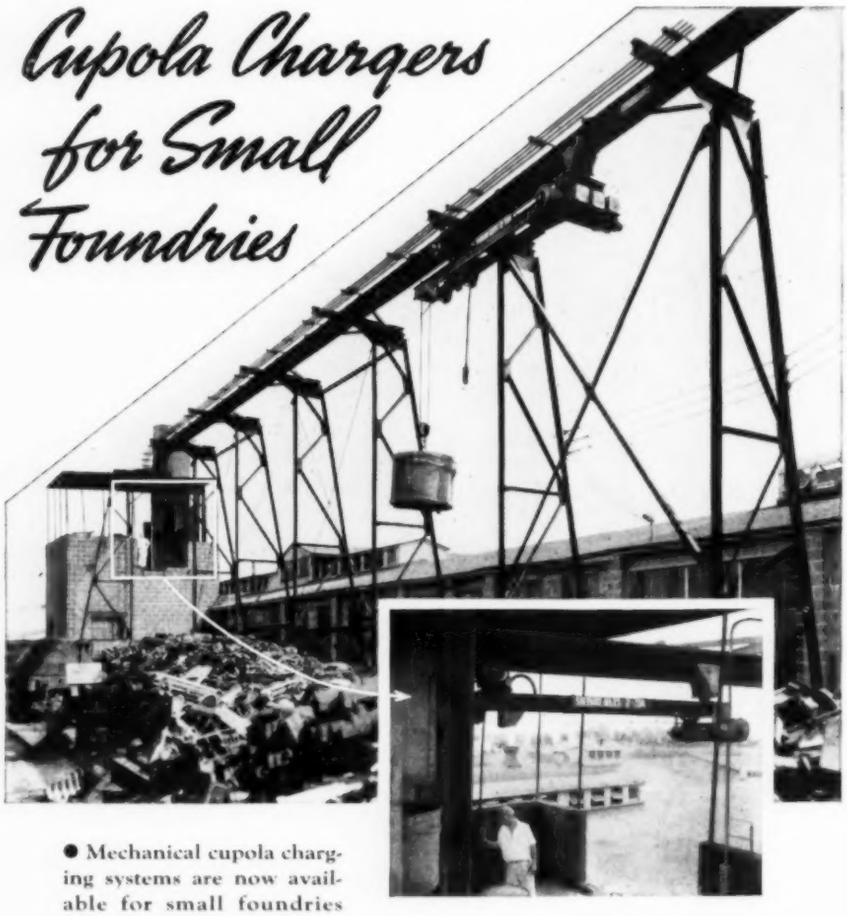
* * *

Frederick W. Herendeen, Geneva, N. Y., manufacturer of boilers and radiators, died recently. Until 1912 Mr. Herendeen was vice president and general sales manager, Herendeen Mfg. Co., Geneva. In 1910 he became vice president, general sales manager and member of the executive board of the United States Radiator Corp., Detroit.

* * *

Lord Austin, 74, died recently at his home at Lickey Grange, Bromsgrove, England. From an apprentice in Langlands Foundry, Melbourne, Australia, Lord Austin rose to be one of the largest motor car manufacturers in the world. He was born at Wentworth near Rotherham and received his early education at the local grammar school, migrating early in life to Australia to receive his engineering training. He never lost interest in foundry work and took a personal interest in the mechanization of the manufacture of castings. Having received the major honors which the motor car industry has to offer, he felt that he could devote some time to the promotion of technical interests of the foundry industry. In 1937 he was elected an honorary member of the Institute of British Foundrymen and president of the British Cast Iron Research Association.

Cupola Chargers for Small Foundries



● Mechanical cupola charging systems are now available for small foundries with daily melts of 15 to 30 tons.

No need for an expensive cupola enclosure or charging floor. An inexpensive runway to carry the charger and an operator's platform at the cupola door is all the construction necessary.

Foundrymen who seek better metal at lower costs—no matter what the daily tonnage may be—can obtain complete information by writing to Montour Falls.

A COMPLETE LINE OF CRANES & HOISTS

SHEPARD NILES CRANE & HOIST CORP.

360 SCHUYLER AVENUE . . . MONTOUR FALLS, N. Y.

Extrusion Press

James A. Murphy & Co., Hamilton, O., has designed a new extrusion press for the production of dough, clay or composition rolls for sealing of molds. The press which is shown in the accompanying illustration comprises a cylinder 6 inches in diameter with a 26-inch stroke. It has a capacity of 660 cubic inches which at one filling

will produce approximately 500 lineal feet of $\frac{3}{8}$-inch diameter roll. Front head is hinged securely to the cylinder and by swinging open the head the cylinder may be loaded simply and easily. Extrusion orifice is separate plug with pipe thread, and placed in center of head. Plugs $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$-inch are standard equipment.

Welding Rod

Ampco Metal, Inc., 1745 South 38th street, Milwaukee has developed a coated aluminum bronze welding rod of exceptional wearing property largely used in aircraft, machine tool, heavy equipment, etc. Advantages claimed for the rod include: Hardness up to 375 brinell; tensile and compressive strength 20 per cent greater than ordinary bronze welding rods; adaptable to any welding method. It has all the outstanding attributes of aluminum bronze, resistance to wear, corrosion and fatigue. Typical uses include over laying forming and drawing dies; building up broken gear teeth; refacing wearing surfaces; repairing broken parts and welding steel, cast iron, bronze and similar metals.

FOUNDRY ACTIVITIES

FOUNDRY department of Mensasco Mfg. Co., Los Angeles, engaged in the production of nonferrous alloy castings by the Antioch process now is operating at full-scale production after two years of experimental and development work. Working only on a semi-production basis during the past year, the plant has been filling orders for aircraft manufacturers on the Pacific coast. However, with improvements in foundry technique and production methods, the plant is prepared to serve the entire industry.

* * *

National Bearing Metals Corp., St. Louis, is building a one-story molding shop addition 37 x 71 feet.

* * *

Canadian Westinghouse Co. Ltd., Hamilton, Ont., is planning to build a plant addition to cost $100,000.

* * *

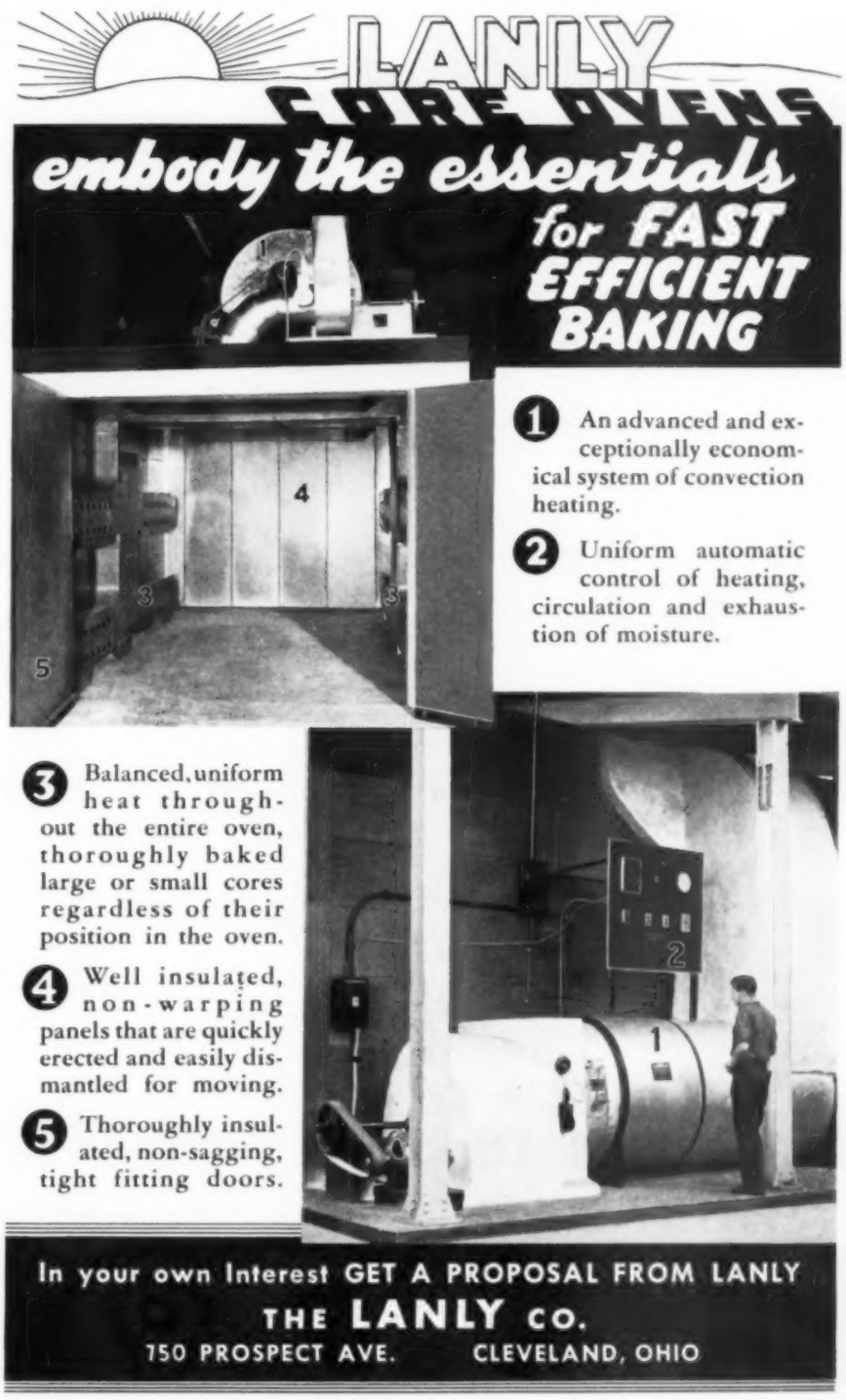
Central Brass Foundry, 217 Locust street, Toledo, O., is erecting a new foundry building of concrete construction to replace th building destroyed by fire. The new building will be 31 x 100 feet, and some new equipment will be installed. David Rayman is president and W. Williams, general manager.

* * *

Cincinnati Foundry Co., 238 West Mitchell Ave., Cincinnati, has rebuilt a section of the foundry recently destroyed by fire. Other additions to the plant include a new all steel corebox storage building and pat-

RAW MATERIAL PRICES
July 16, 1941

Iron	
No. 2 foundry, Valley	$24 to 24.50
No. 2 Southern Birmingham	20.00
No. 2 foundry, Chicago	24.00
No. 2 foundry, Buffalo	24.00
Basic, Buffalo	23.00
Basic, Valley	$23.50 to 24.00
Malleable, Chicago	24.00
Malleable, Buffalo	24.50
Charcoal iron, furnace	28.00
Coke	
Connellsville beehive premium	$7.25 to $7.60
Wise county beehive coke	7.50
Detroit by-product delivered	12.25
Scrap	
Heavy melting steel, Valley, No. 2	$19.00
Heavy melting steel, Pittsburgh, No. 2	19.00
Heavy melting steel, Chicago, No. 2	17.75
Stove plate, Buffalo	19.00
Stove plate, Chicago	17.00
No. 1 cast, mchy., drop broken, Chicago	21.50
No. 1 cupola, Pittsburgh	21.00
No. 1 cupola, Eastern, Pa	23.00
No. 1 cast, mchy., drop broken, Birmingham	21.50
Car wheels, iron, Pittsburgh	.....
Car wheels, iron, Chicago	.....
Railroad malleable, Chicago	.....
Malleable, Buffalo	.....
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	12.25
Straits tin	53.25
Aluminum, 99 per cent	17.00
Aluminum, No. 12 (Secondary, standard)	16.00
Lead, New York	5.85
Antimony, New York	14.00
Nickel, electro	35.00
Zinc, (Prime) East St. Louis, Ill.	7.25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3 Balanced, uniform heat throughout the entire oven, thoroughly baked large or small cores regardless of their position in the oven.
4 Well insulated, non-warping panels that are quickly erected and easily dismantled for moving.
5 Thoroughly insulated, non-sagging, tight fitting doors.
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THE LANLY CO.
750 PROSPECT AVE. CLEVELAND, OHIO

tern vault. It is stated that the foundry is running to capacity and has booked orders for a long period in the future. George C. Euskirchen is president and George A. Euskirchen Jr., is general manager.

* * *

Detroit Suburban Foundry Co., Birmingham, Mich., has been organized to make castings by Anthony E. Furman Jr.

* * *

Otis Elevator Co., 775 Main street, Buffalo, has let general contract for the construction of an annealing oven building to cost about $60,000.

* * *

Deere & Mansur works of Deere & Co., 501 Third avenue, Moline, Ill., manufacturer of planters, disk harrows, endgate seeders and stalk cutters, will build a 110 x 220-foot gray iron foundry to cost $131,000, with $25,000 additional for equipment. Completion is scheduled for late this year or early next.

* * *

Philip Gies Foundry, Water street, Kitchener, Ont., will build a foundry addition on Charles street, to cost about $50,000, with equipment.

* * *

In 1937, in order to serve the airplane industry more effectively, the Aluminum Co. of America, Pittsburgh, purchased 15 acres of land in Vernon, a section of Los Angeles and built a sand and permanent mold foundry and forge plant. At the start of the war, the Vernon plant had a capacity of 424,000 pounds of aluminum castings a month. Buildings necessary to house additional fabricating facilities in Los Angeles now have been completed and equipment is being installed to handle increased production so that the sand and permanent mold casting capacity will be increased to 593,000 pounds a month, an increase of 40 per cent.

* * *

Pacific Cast Iron Fitting Co. is erecting a new warehouse addition to its foundry at 9430 Rayo avenue, Los Angeles, at a cost of $15,000.

* * *

Canada Iron Foundries Ltd., 227 St. Maurice street, Three Rivers, Que., is building a plant addition to cost about $100,000 with equipment.

* * *

Hard Metal Co., Spokane, Wash., a subsidiary of Columbia Machine Inc., New York, is building a plant to handle a $300,000 navy contract for steel castings.

* * *

Atlas Foundry Co., 3600 West Sixty-ninth street, Cleveland, is building a 33 x 100-foot addition to cost about $4500. J. H. Bruce is president..

* * *

Phillips & Buttorff Mfg. Co., 217 Third avenue North, Nashville, Tenn., is building a three-story stove foundry addition on Thirteenth street.

* * *

T-Die Cast & Metal Products is the firm name under which J. T. Teissere has obtained certificate to conduct business at 441 West 105th street, Los Angeles.

* * *

Sully Brass Foundry Co. Ltd., 7 Wabash avenue, Toronto, Ont., has let general contract for the construction of a plant addition to cost $20,000, not including equipment.

* * *

Hanford Iron Works, 119 South Arrowhead avenue, San Bernandino, Calif., has been issued a building permit for remodeling its building at a cost of $2000.

* * *

Union Malleable Mfg. Co., Clark avenue, Ashland, O., is forming a subsidiary, Ashland Malleable Iron Co., to take over Ashland Malleable Co., Virginia avenue. L. H. Katz, is president.

* * *

Ampco Metal Inc., Milwaukee, is erecting a new foundry addition which will practically double present floor area. The new addition will be devoted to production work,

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It would look nice and be nice in YOUR foundry.

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PENNSYLVANIA, U. S. A.

allowing long runs of castings to be handled continuously. The new foundry addition comprises 60,000 square feet of floor area. It will be double-decked in part. According to the preliminary plans, the center bay of the new structure will be used for production and heavy molding, cleaning and shipping. A conveyor system will handle castings to the cleaning floor and shipping department. Over the center bay will be a crane way. Three large electric cranes will be used to handle heavy material such as castings and flasks. The east bay will house a battery of rocker type electric melting furnaces with the necessary electric substation. Below, reached by ramps, will be two metal storage rooms. The frame work of the new addition is constructed of structural steel, with sidewalls of concrete block and large areas of steel sash. The windows in the monitor are center pivoted steel sash, and designed to allow ready exit of foundry fumes and gases.

* * *

Revised plans for a foundry building in Greenville, Mich., have been prepared for Federal Mogul Corp., Detroit, by Robinson, Campau and Crowe, Grand Rapids, Mich.

* * *

Defiance Machine Works, subsidiary of the Toledo Scale Co., Defiance, O., is constructing a new building to provide expansion of the foundry's cleaning, inspection, storage and shipping departments.

* * *

Pacific Car & Foundry Co., Seattle, is considering the building of a new steel foundry to meet defense requirements of the Navy and maritime commission, and other essential projects in that area.

* * *

Meta-Mold Casting Co., Los Angeles, has been incorporated with 2500 shares of stock. Directors are: Walter Rachael, James C. Titus and William D. Witherspoon, all of Los Angeles.

* * *

Scovill Mfg. Co., Waterbury, Conn., is planning a $450,000 addition to its casting shop. The building will be two to four stories in height 330 feet long and 37 to 80 feet wide.

* * *

Grand Rapids Malleable Works, Grand Rapids, Mich., is reopening. It is owned by the Chicago Railway Equipment Co., and formerly produced railway equipment and automotive castings.

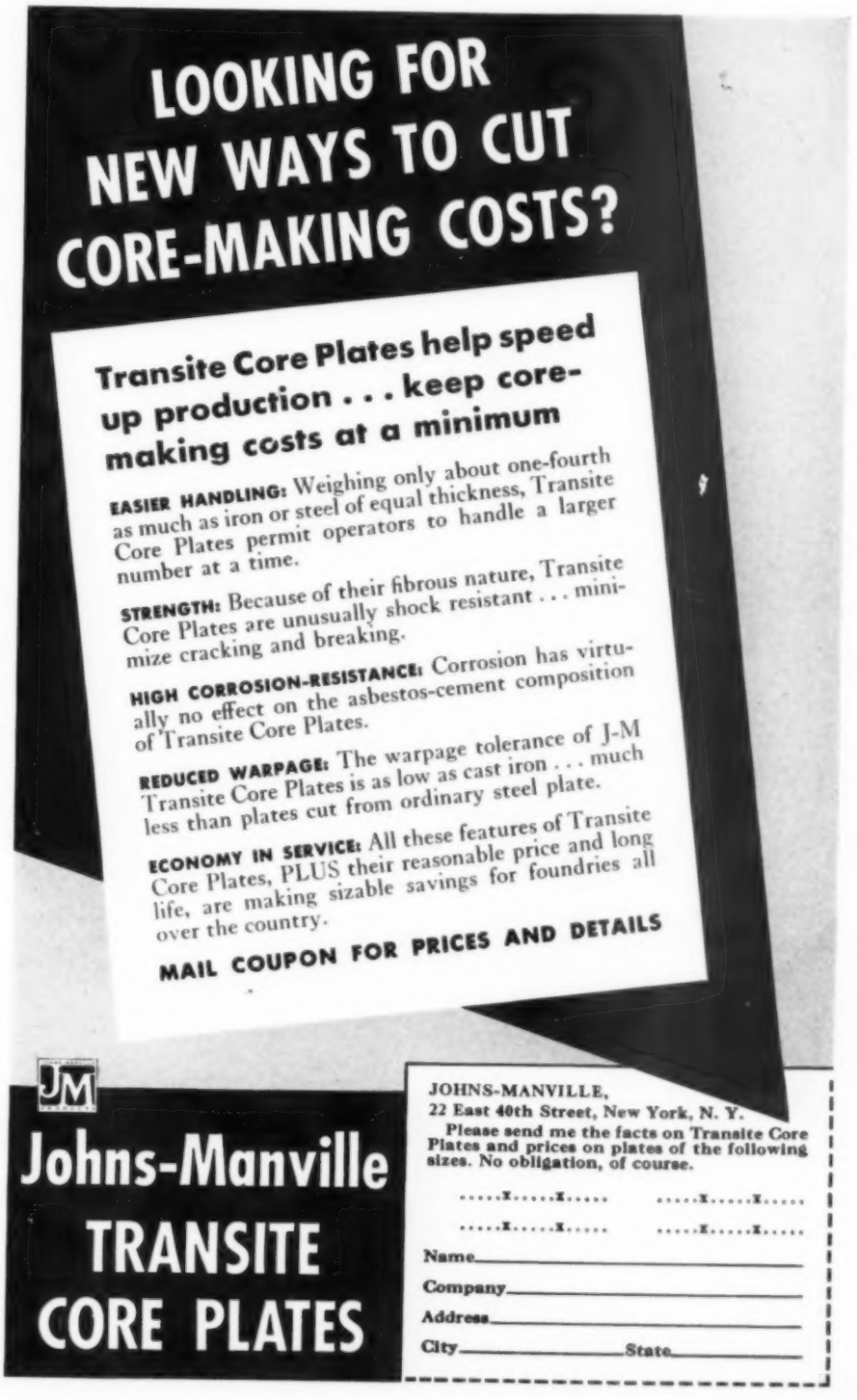
* * *

Allyne Ryan Foundry Co., 8916 Aetna road, Cleveland, is building additional storage space and is enlarging core room. The storage space will be 28 x 16 and 28 x 124 feet, and the core room is to be 40 x 72 feet. Frank Feldes is plant superintendent.

Level Control

Photoswitch Inc., 21 Chestnut street, Cambridge, Mass., has developed a unit claimed to be a simple electronic relay for level control of conductive and nonconductive fluids and powders. Equipment is available to meet all specifications, single level control, on and off control at two levels, boiler feed water and tank condensate signals. Installation merely entails attaching a probe fitting to the surface of the tank. For two level control the probe fittings or electrodes are attached to the two levels where pumping starts and stops. Special tank fittings are available for use in corrosive liquids.

Facts for Foundrymen is the title of a 76-page booklet recently made available by the Niagara Falls Smelting & Refining Corp., 2204 Elmwood avenue, Buffalo, N. Y. It is the fourth edition, and contains information on various alloys supplied by the firm as well as methods of making various alloys.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Transite Core Plates help speed up production . . . keep core-making costs at a minimum
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3-ply frame material cannot split and "run" with the grain. Another reason why "Tri-Ply" riddles will give added months of useful service.

NO CROSS WIRES
Special construction, shown below, makes cross wires unnecessary. This feature adds materially to screen life through elimination of extra abrasion.

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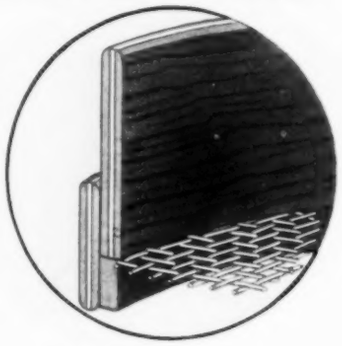

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TRI-PLY RIDDLES
COST NO MORE

MAKING NONFERROUS TEST BARS

(*Continued from page* 65)

tions. This means that those castings cast under well standardized and well planned conditions will have physical characteristics indicated by the test bar within the reasonable proportion of the total depending upon the conditions under which the castings were made, the possibility of proper feeding and the peculiar conditions arising from the sections of the castings, the relationship between thick and thin sections and the like.

Furthermore by use of standard test bars cast under controlled conditions two castings chosen from two different heats should show the same proportional physical characteristics to the test bars from those same heats. Thus, if the test bars of two heats both indicate 50,000 pounds per square inch tensile strength and elongation of 12 per cent and one casting tested at a certain point in the casting indicates 60 per cent of the yield strength indicated by the bar, a similar casting similarly tested from the heats represented by the other bar should show the same percentage of the values indicated by the bar.

Test Bars Without Defect

It is a well known fact that castings must be sound, free from blow holes, gas holes, inclusions of slag or other foreign materials if they are to be of the best quality. That means the metal entering them must be clean and free from inclusions of the above mentioned types and must be poured into the mold so that the metal lies quietly in the mold cavity and does not boil. The metal must be fluid enough to fill out the entire cavity sharply and must be fed properly to give the most satisfactory results. In order to measure the question of whether the metal poured into a casting is of this order a standardized method of testing has been laid down by those who have laid down specifications.

Standard test bars are outlined and the preferred method of locating of the bars has been more or less agreed upon by the foundrymen who regularly are producing castings that must meet physical tests of this kind. For those compositions containing 80 per cent or more of copper, such as the standard 85-5-5-5 alloy, or the 88-10-2 (government G metal) or the 88-8-4 (government metal) the government specifies the use of test bars cast as shown in Fig. 47. The bars are located so that half the bar is in the drag and the other half is in the cope above which is the riser extending the entire length of the bar and connected to the bar by a fin gate which runs the entire length of the bar and is about 5/16-inch thick.

It is important that the connection between the gate and the casting should be filleted properly and it is likewise important that a fillet be provided where this thin gate joins the thicker riser so that the cooling of those junction points will not develop a valve condition that will shut off the feeding for which the riser is provided. Some manufacturers prefer to cast this bar with the riser and bar in a horizontal position, that is with the riser at the side of the bar instead of above the bar.

Provide Ample Gate

Where this method is adopted it is well to be sure that the riser is slightly above the level of the bar. In other words, a line through the center of the riser and bar should be slightly inclined so that the bar end of that line is lower than the other end of that line. When gating those bars an ample gate should be led into the end of the bar when the riser is above the bar or when the riser is in a vertical position. If the riser is in a horizontal position as previously mentioned it is better practice to gate into the end of the riser so that it fills first part way, then flows over through the connecting gate into the bar cavity. That provides metal in the bar at a slightly lower temperature than in the riser, thus insuring the cooling of the bar before the riser has cooled.

When these bars are cast in the vertical position with the riser above them naturally the hot metal rises up into the riser, and the temperature differential between riser and test bar is maintained in the desired relation; that is the bar cools before the riser does.

It is to be noted here that in discussing the question of cooling condition of the bars and other factors outlined previously we are referring particularly to that part of the bar which is the test part, namely the smaller part of the bar in the middle where the actual testing occurs.

In the production of the higher strength compositions, like aluminum bronze, manganese bronze, silicon bronze, monel metal the government and others who have prepared specifications recognize the need for a very much larger body of metal to act as a feeder and furthermore they prefer to have several bars cast or attached to the same riser for convenience sake. It is obvious that it is always desirable to have several bars from a given heat.

In the first place, the government wants a bar, the manufacturer wants a bar, and there may be occasions

when there is a debate as to the characteristic of the particular heat and therefore there should be an umpire bar. Thus, the necessity for at least three bars can be seen. Consequently, the bar that is now more or less standard for these high shrink alloys is that indicated in Fig. 48. As may be observed the large shrink head has two separate bars beneath it from which may be cut two bars each, thus making four test bars available from this standard test equipment.

The bars must be sawed from the shrinkage head and thereafter machined to the desired size of a standard test coupon but it is very vital that all such test specimens should be machined carefully to size if comparison is to be fair and if comparison is to be based on a reasonably standard condition. There are those who prefer to use bars that are cast to size and test them without further machining. It should be pointed out that this is not a fair comparison in the case of such tests.

In the first place the parting line of such bars is always ground to remove the fin. That is inevitable. That operation removes the skin from only one portion of the bar and since the skin has different characteristics than the rest of the metal in the bar the amount of skin removed will affect the comparative results. Furthermore, such grinding operations are not accurate and consequently, since the diameter of the bar is not accurate, computation of physical strength per unit of area is not accurate and may be very misleading.

Bar Known as Keel Block

There is another type of bar which is received favorably by manufacturers and those who are making frequent tests of cast high shrinkage alloys that is the bar shown in Fig. 50 and known as the keel block bar. It will be seen that this bar is made up of heavy shrink head on either side of which is cast a bar which may be sawed off and at the bottom of which is another bar to be sawed off for test. This provides three bars, one for the manufacturer, one for the tester and one for the umpire. While the dimensions of the bars indicated will provide a 1-inch square section after sawing from the head, they may be varied to some degree by the individual foundry.

Those bars, if conditions are maintained correctly or properly fed should be uniformly accurate as to the characteristic of the metal cast in that riser. This bar has one advantage over the bar shown in Fig. 48 in that there is no superheating of the sand at any one side of any one bar. The sand beneath the riser in test bars shown in Fig. 48 is located between two groups of test bars. The bars on either side of that piece of sand increase the temperature of the sand so that the cooling condition of the bars is not identical on the two sides of any one bar. That is a factor that is not important but it does sometimes give rise to difficulties that form the subject of debate.

Furthermore, in the bars cast in Fig. 48 there is sometimes some difference between the bar at the bottom of the test coupon beneath the riser as compared with the bar immediately attached to the base of the riser. That is influenced partly by the effect of the superheated sand and partly by the conditions arising from the problem of feeding one bar through the other which in turn is influenced by the temperature at which the metal entered the complete bar assembly mold.

It is frequently convenient to make up cores that when assembled form the necessary cavity for the production of the test assemblies so that the cores may be rammed into the mold in such positions as to provide the necessary mold cavity for the casting of the bars. That avoids the necessity for incorporating in the mold patterns of the test bar and riser assembly which must be drawn individually since they are not necessarily part of some pattern plates. Furthermore like the government, many others as well specify several test bars to be cast. Therefore, several loose patterns must be so located that they con-

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Norton Cut-off Wheels

in the Core Room

Are the Speedy Way to Cut Stock Cores

SPEED in production is the keynote in every foundry today and there's certainly no faster way to cut stock cores to length than with Norton Cut-off Wheels. They quickly and easily slice through sand cores of all sizes and shapes.

Norton Cut-off Wheels for the core room are made of Crystolon abrasive and the bond can be either resinoid or rubber. Typical specifications are 3724-P8T or 3724-R0R.

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nect properly with the gates and a core assembly is frequently much more convenient.

Use of dry sand cores for that purpose may be criticized by some in that the cooling effect of the dry sand is not exactly that of green sand. Obviously green sand which contains moisture, would require the evaporation of the moisture and a consequent more rapid cooling would develop than in the case of dry sand cores. The dry sand cores should be made so that they may be held in stock ready for use. Consequently, they must be made with a bonding material that does not absorb moisture while standing on the stock shelves. Oil sand cores are much to be preferred.

The federal specifications that cover the subject of test bars, namely QQ-M-151 may be obtained from Superintendent of Documents at Washington. The specifications are revised from time to time and when revisions occur there is a small letter added to the figure. The most recent of these is QQ-M-151a and from that Fig. 51 shows the latest drawing for the standard test bar for the phosphor bronze and red brasses with the specified location of gate.

Gate Bars at End

However, there is no objection to gating the bars at the end of the bar instead of at the end of the riser as previously mentioned. Fig. 51 is the equivalent of Fig. 47. In the same specification as shown in Fig. 49 the dimensions of the bar as finished machined are given, indicating the proper fillet at the junction of the thin testing section and the thick section for the grips. It also indicates the other dimensions so that there can be no doubt as to what is acceptable by the federal government for finished machined test bars and the subject of the bars as finished is discussed further in this article.

In gating the standard test bars the gates should be of such size as to produce a free flow of metal but they should not have a restriction at their junction with the mold assembly cavity which will result in the squirting or spraying of the metal into the cavity and cause the mixture of air and gasses with the metal as the metal enters the mold cavity. That tends to form scum which may be entrapped in the castings and thus give poor account of an otherwise good heat of metal.

Furthermore, in such alloys as the silicon bronzes or aluminum bronzes the metal should be led into the mold cavity as quietly as possible and preferably at the end of the mold so that it runs lengthwise of the bar. It will be found desirable where there are two sets of bars attached to the same riser as in Fig. 48 to use two gates, one into each of the two bar cavities, so that the metal does not have to cascade over the edge of the sand from the one bar cavity into the other.

Cascading is likely to give trouble where alloys are being cast which have that characteristic known as soapy or foam forming ability. Silicon bronze and aluminum bronze are examples. Therefore it is desirable to cast the bar assemblies by having the metal enter at the lowest point where possible through gates that are designed so that there is no nozzle effect. The gates should be of ample size to permit free flow of metal without agitation or dislodgement of sand from the sides of the mold cavity or in any way produce conditions that will cause mixture with gases or sand with an otherwise free and clean supply of good metal.

Attach Test Bar To Casting

It frequently is demanded that the test bars must be attached to the casting so that the inspector may see that the bar was cast from the same pot of metal used to pour the casting. That is accomplished easily by arranging the gates so that the same gate that leads to the casting leads to the test bar. When the gates are cut off enough of the gate is left to keep the test bar attached to this casting until the inspector has been able to stamp casting and bar with his heat number and other identification as acknowledgment that the test bar and casting were poured from the same heat of metal.

A well melted and properly alloyed heat of metal when poured into the bars described and now accepted as standard by the federal government and the testing societies will give relatively uniform results. When the test bars have been properly machined to the standard dimensions provided for such tests there should be no difficulty in having comparable results in comparing one heat with another of the same composition of metal. There is one factor that should be emphasized and that is machining of the bars. Accuracy is an important factor and tooling grooves or marks necessarily will affect the accuracy of results since the depth of a tool mark may influence the measurement of the cross-sectional area being tested.

Furthermore, the fillets at the junction of the thin testing section with the thick section provided for the grips in the machine should be ample and properly turned to insure smooth change of dimension from the testing size to that of the grip size. This is recognized by many testers but cannot be too strongly emphasized.

SPEEDS MACHINE TOOL PRODUCTION

(*Continued from page* 64)

to 11,400 pounds. Essential features are similar in all models, with the principal difference showing in the total overall length. The pattern in each case is split through the center longitudinally so that approximately one half of the pattern is molded in the drag and one half in the cope of a special flask designed to reduce the amount of sand to a minimum. Principal features of the drag half of the flask previously were shown in Fig. 1 in the July issue with the empty sections closed off from the remainder by a heavy partition member braced from the outside wall of the flask by short transverse ribs about 2 feet apart.

An extension flask, also known as a frame or upset, is bolted over the section of the flask where the gear box part of the pattern projects above the remainder of the pattern. The strongly braced pattern board is provided with suitable devices for locating the pattern accurately in relation to the ends and sides of the flask and the drag is clamped to the board during the ramming operation to prevent any change in position. The frame or upset at one end of the flask is bolted to the remainder of the flask and remains permanently in place.

Bottom Plates Bolted

The bottom plate is in two sections, one for the deep and one for the shallow part of the drag. After the ramming is completed the sand surface is scraped off flat with a straight edge and the two plates are lowered into place. The sand surface is left high enough to prevent the plates from coming into actual contact with the walls of the drag. Wedges are driven between plate and drag to maintain this opening and permit free exit for the gas generated in the mold during the pouring process. The plates are rapped down to a solid bearing and then secured by a number of bolts to the flange of the drag. Bolts are preferred to clamps which occasionally work loose. Bolt holes in the flask flange are oval instead of round to permit more ready insertion of the bolts.

Position of the pattern in the mold marks a radical departure from the orthodox practice in machine tool foundries where the ways or guides on which the tail stock slides invariably are cast on the bottom of the mold. This of course is to insure the presence of clean,

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AVOID MISTAKES . . .

Unless experienced, not a single person or group of individuals can master the multitude of knotty problems which invariably present themselves in carrying out a new project. Present and future requirements must be surveyed before selecting equipment for continuous melting, molding and pouring, also for core room, cleaning departments, ventilating systems, etc. This also applies in planning size, type of building, material storage and all co-ordinate departments.

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solid metal in a part of the casting which is tooled and then finished to the nicest degree of accuracy by hand. Gisholt lathe beds are produced on the basis that every part of the casting is clean and solid. Therefore position in the mold is immaterial from that standpoint. The present method with the ways on one side of the casting, one in the cope and one in the drag was adopted to simplify the operation of making the mold and setting the cores.

With the cores all in place in the drag, a small clay ball slightly higher than the required casting thickness is placed on each point to be occupied later by a chaplet. The cope then is lowered into place, guided by long steel pins at the ends of the flask. In addition to guiding the cope into place the long pins prevent the cope from rubbing or scraping the cores which project above the parting line. After the cope has come to rest, it is lifted and removed temporarily while the molder sets the chaplets on the cores. The weight of the cope presses down the soft clay and indicates the exact thickness between the cores and the face of the cope. The chaplet first is placed alongside the clay to note any discrepancy in the height.

Use Cast Iron Chaplets

In the majority of instances the height is the same. Where the chaplet is a trifle low, a thin shim of perforated tin coated metal is placed underneath. Commencing at one end of the mold, the molder removes each clay ball and replaces it with a cast iron spool chaplet. The openings around the loops provided for lifting the cores are filled with sand and slicked over. A clay or dough worm is placed on the joint to insure intimate contact between cope and drag and prevent any leakage of metal when the mold is filled. The cope then is returned to place on the drag and the two parts are clamped together. Riser cups and runner basin are made up and the mold is ready for the reception of the molten metal.

Small molds are poured from a single ladle, but two ladles are employed to pour the heavy castings. Metal from the sprue enters a horizontal runner cut in the joint near one end of the mold. A certain amount flows down through a second sprue in the drag and enters the mold through a gate at the bottom. The remainder flows into the mold through gates at the joint of the mold. The arrangement is shown at the left end of the mold in Fig. 9.

Two cupolas, one lined to 60 and the other to 48 inches, made by the Whiting Corp., Harvey, Ill. are provided for melting the metal. Under present conditions the larger cupola is used exclusively while the smaller cupola is held as a spare to be pressed into service when and if necessary.

Coke, limestone and iron charges for the cupola are loaded into wheeled buggies and taken by elevator to the charging floor where the iron is weighed on a floor scale. Adjustment in the weight is made at this point to bring each load of iron to the desired weight 2000 pounds. The charging floor is spacious enough to hold the entire supply of materials for the day's heat. Coke and limestone are measured for each charge, 250 pounds of coke and 75 pounds of limestone. The cupola is charged by hand through two doors. Limestone is measured with a scoop and coke is measured in a number of steel containers. The charges vary in composition to suit the various classes of castings. Schedule showing the charging and pouring program is posted on a blackboard near the cupola to assist the man in charge of distribution of the iron to all parts of the foundry. As each ladle is tapped and taken away from the cupola spout, the item is checked on the blackboard.

After the castings are shaken out they are transferred by the crane to the cleaning department at the west end of the main bay. Large castings are hooked directly to the crane chains, while the small miscellaneous castings are loaded in boxes. Some of the small castings are cleaned in tumbling barrels, but the great majority, small and large are cleaned in a special chamber equipped with a hose and nozzle which discharges a combination stream of water and sand under a pressure of 1200 pounds per square inch and at a speed of 3 miles per minute, or 264 feet per second.

Reduce Cleaning Time

Under the tearing impact all clinging sand on the outside of the casting disappears rapidly. The gun then is aimed at the inside. Cores are broken up, knocked to pieces and washed out of the casting at a speed that is incredible to any person accustomed to former methods which depended on a chisel bar, a sledge hammer and main strength. On large lathe castings containing a complexity of cores it is claimed the cleaning time has been reduced from 20 to 2 hours.

While most of the castings are loaded on cars and pushed into the chamber, exceptionally large castings suspended from the crane may be lowered through an opening in the roof and placed either on the floor or on an empty car. The crane then is available to turn the

casting over if necessary. This wet process of removing sand also removes the dust hazard both in the chamber and in the surrounding atmosphere. Castings that formerly were given a coat of priming paint in a separate department, now are treated in close proximity to the water cleaning chamber.

Auxiliary equipment in this washing and cleaning unit developed and installed by the Hydro-Blast Corp., Chicago, reclaims all the sand and returns it for use. Through an elaborate system of screens, piping and magnetic devices the sand is cleared, classified according to grain size and the fines are removed in any predetermined amount to meet permeability requirements. General layout of the installation is shown in Fig. 10. Some of the sand goes to the molding floors, but the greater part is utilized in the coremaking department. Bonded with a minimum amount of cereal or pitch binder and with an additional amount of clay where the occasion seems to warrant, the sand is employed exclusively for making a wide variety of plain and complicated cores.

Fresh water for the gun is supplied from the mains through a pump which raises the pressure to 1200 pounds per square inch. Before the water reaches the gun it passes through a series of venturi nozzles where it creates a vacuum which sucks the sand from the blast tanks and delivers it immediately behind a replaceable jet in the gun. Abrasive wear is confined to this jet. In a medium size application the jet delivers about 30 gallons of water and from 70 to 100 pounds of sand per minute. This is not a special abrasive sand, but is part of the supply developed and reclaimed as a regular function of the apparatus.

After the blast sand tanks are filled, the excess sand from the classifiers is delivered to a top feed rotary filter wheel where it is dried by vacuum suction of hot air to 2 per cent or less moisture content and then conveyed to the storage bins. This recovered sand is a uniform product which can be used as a constant basis for any desired mixture. Rods, gaggers, and arbors are not lost, broken or twisted. They are removed intact after the sand has been removed from the casting.

In addition to economy effected in reduction of time required to clean the castings, many other incidental and advantageous features are claimed for the system. Men work better in clean air. Machines and motors last longer where there is no abrasive dust in the atmosphere. Maintenance costs go down. Possibility of expensive break downs are eliminated. Accident risks are lowered. Attention is directed to the fact that the obvious method to control dust, is to use methods which do not create dust.

Compressed air for plant use is supplied by a recently installed steam driven unit with a capacity of 960 cubic feet of air per minute at 90 pounds pressure. This unit supplements an older machine of the same type with a capacity of 640 cubic feet of air per minute. Both machines were supplied by the Ingersoll-Rand Co., New York. The older machine serves as a standby in case of overload or breakdown and it is stated, runs as efficiently today as in the earlier periods. In many instances the demand for air necessitates operation of both compressors.

This is the second of two articles dealing with methods, materials and equipment in the gray iron foundry of the Gisholt Machine Co., Madison, Wis. The first article appeared in the July issue of THE FOUNDRY.

THE EDITORS.

Recognizes Work of Wisconsin Chapter

Two activities of the Wisconsin Chapter which have focused attention of engineering schools of the state on the importance of the foundry industry was the establishment of student loan funds at the University of Wisconsin and Marquette University, and the sponsorship of essay contests on foundry subjects in the same schools. Recognition of that co-operation between the chapter and the universities is illustrated in a letter from F. Ellis Johnson, dean, college of engineering, University of Wisconsin to B. D. Claffey, president of the Wisconsin Chapter, which is as follows:

> As the occasion now arrives when your association is to award prizes to our students for the winning essays on foundry practice, I wish to express for our College of Engineering and myself our very sincere appreciation of this further co-operation on the part of the American Foundrymen's Association.
>
> We are particularly pleased that the offering of these awards has been successful in stimulating the production of papers of as high quality as we understand these student papers to be. The stimulation of such interest cannot help but repay not only the efforts of the young men concerned, but all of us who are so much interested in advancing this important field of industry.

National Bureau of Standards recently has published a research paper RP 1366 entitled, "Influence of Stress on the Corrosion Pitting of Aluminum Bronze and Monel Metal in Water." Authors of the paper are D. J. McAdam Jr. and G. W. Giel.

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FUNDAMENTAL ASPECTS OF FOUNDRY SAND

(*Continued from page* 61)

Ramming of the British specimen is based upon a term called *index of ramming*. This term may be expressed as follows:

(a) Index of ramming = $\frac{\text{dry apparent density}}{\text{true density}} \times 100 - 42$

(b) The term $\frac{\text{dry apparent density}}{\text{true density}} \times$ 100 actually represents the percentage volume occupied by the grains or 100 minus per cent dry voids. Expression (a) may then be written:

Index of ramming = 100 − dry voids − 42.

The percentage of dry voids for all sands tested in the present investigation are constant between 1.5 to 12 per cent moisture (Fig. 3). Each sand, both according to size and to shape, has a different percentage of dry voids. Therefore, the A.F.A. method of ramming gives a constant index of ramming for clay-free sand within the above indicated moisture range. The individual *index of ramming* numbers of the various mesh sizes tested are given in Table II.

Flowability Is Constant

Since the flowability (change of specimen height between the fourth and fifth blow) depends on the intergranular friction, and is constant above 2 per cent moisture, it may be predicted that the flowability is constant and independent of moisture content above this percentage. Fig. 4 in the July issue shows this to be true. The results obtained for round grains are more uniform than those obtained for angular sand values. The former grains are less influenced by surface conditions.

Comparing Figs. 2 and 4 indicates that the higher the flowability, the higher the density. A high flowability number means less internal friction, and such sand can be compressed to a higher degree with the same amount of compressive work applied.

A series of flowability tests were performed on sand grains dried at 225 degrees Fahr. and cooled in a desiccator. Flowability values of 92 to 97 were obtained in this way for round grains, a greater value than was obtained when the moisture content was about 0.2 per cent. This confirms the previous statement regarding the influence of moisture on the internal friction.

Fig. 5 in the July issue and Fig. 7 show the relationship between the moisture content and height of specimen of constant weight (170 grains for the round sand, and 140 grains for the angular). The experimental values give a straight line for moistures above 2 per cent. This is to be expected since the "dry apparent density" remains constant above this amount, and the increase in weight is due to additions of water at the expense of sand grains.

The following equation gives the relation between the height of the specimen and moisture for samples of constant weight and constant density:

$$h = \frac{W - \frac{W M}{100}}{D_a A}$$

where h = height of the specimen in centimeters; W = the constant weight chosen in grams; M = percentage of moisture; D_a = dry apparent density in grams per cubic centimeter, and A = area of specimen in square centimeters. This is the equation for a straight line.

Curves Show Relationship

Figs. 8 and 9 show the relationship between permeability and water content for different sand grains. Each sand in Fig. 8 is represented by two curves, one showing the regular green permeability, and the other the dry permeability. In Fig. 9 green and dry permeability is given for 70- and 30-mesh sand, respectively. The dry permeability results confirm conclusions from weight-moisture and flowability-moisture experiments, namely, that the dry apparent density is constant above a certain water content.

The dry permeability curve consists of two parts, namely, one curved and one straight. The complete curve has the same general shape as the dry void curve given in Fig. 3 in the July issue. Both curves very well represent the intergranular friction, increasing from dry state to about 2 per cent moisture, and remaining constant above this figure.

Chief interest centers about the green permeability curves. In order to study these values in greater detail, curves for 40-mesh round grains are reproduced in Fig. 10 as follows: Green and dry permeability. Green and dry voids (interstitial volume). Green and dry weight of standard weight specimens. Flowability. Water influences the green permeability in three ways: 1. By increasing the intergranular friction in the moisture range from zero to about 1.5 per cent. 2. By modifying the interstitial or void shape, chiefly in the range from 1 to 5 per cent. 3. By filling up the interstitial or void space, chiefly in

the range of 4 per cent to the maximum percentage.

Factors 2 and 3 cannot be separated. Their influence is simultaneous, but one or the other predominates in the respective ranges

given previously. The first increase in permeability with moisture increase is the result of intergranular friction which increases intergranular space. In this particular range, the green and dry permeability coincide because the water has not yet changed the shape of the intergranular space. A further increase in moisture causes a further rise of green permeability even though the true void space is decreasing. The true voids (intergranular space) begin decreasing from about 0.7 per cent moisture.

The green permeability is near maximum at 1 per cent moisture, although the void space is decreasing. In comparing the dry permeability curve with the green, the latter is greater than the former in the moisture range of 0.5 to 2 per cent. The water, although decreasing the void space, in reality has increased the permeability. This anomaly may be explained as follows: The thin film of moisture that encloses each grain tends to fill up the surface irregularities, such as pits. Smooth surfaces offer less resistance to air passage than rough surfaces. Further increase in water begins filling the wedge shapes adjacent to the points of contact.

All sharp and wedge-shaped pockets of the intergranular spaces will be eliminated gradually, increasing the green permeability, notwithstanding the fact that the actual intergranular volume is being decreased. This is shown in Fig. 6.

That modifying effect of water on green permeability will be different for different types of sand. The filling of the wedge spaces at the points of contact cannot be the same for angular and round sand grains. It is difficult to draw conclusions from the curves given in Figs. 8 and 9 because of the difference in density between the two types of sand.

The drop in the green permeability curve in Fig. 10 is influenced chiefly by increased water filling up the voids. That can be seen by comparing the permeability and the true void or intergranular volume curves. The shape factor must not be overlooked. Surface tension forces the water to build a film and eventually bridge all openings. The passages of air through the sand body will be closed before the intergranular voids are completely filled with water. The different meshes of round sand gave zero permeability at 12 to 13 per cent moisture, even though the calculated intergranular volume was still 20 per cent.

Buchanan in the *Foundry Trade Journal*, 1938 and 1940 has stated that the green permeability is independent of moisture content at constant *index of ramming*. That may be true for a short interval in sands of high clay content, but the present investigation shows that it is basically impossible.

This phase of an extended investigation on some observed properties of sands deals with clay-free round and angular grains when the moisture content is varied. Using the A. F. A. method of preparing test specimens, the following results were obtained:

1. Round sand grains are more flowable than angular grains.
2. Round sand grains are more dense, when rammed, than angular sand grains.
3. Angular grains have greater intergranular space when rammed.
4. Angular grains have higher permeability than round grains.
5. Between the range of 2 to 12 per cent, water variation has no effect on (a) intergranular void volume. (b) dry permeability, and (c) flowability.
6. In a relatively low moisture range (about 0.5 to 2.5 per cent for round and 0.5 to 4 per cent for angular grains), the green permeability exceeds the dry permeability values.

The greatest shortcoming and criticism of the A. F. A. method of ramming a standard specimen is the inability to continually duplicate results obtained when using a sand for repeated tests. This change has been attributed to the change of shape and surface condition of the sand grains.

This is the second and concluding article of a series of two on some of the fundamental phases relating to foundry sands. The first article appeared in the July issue.

THE EDITORS.

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